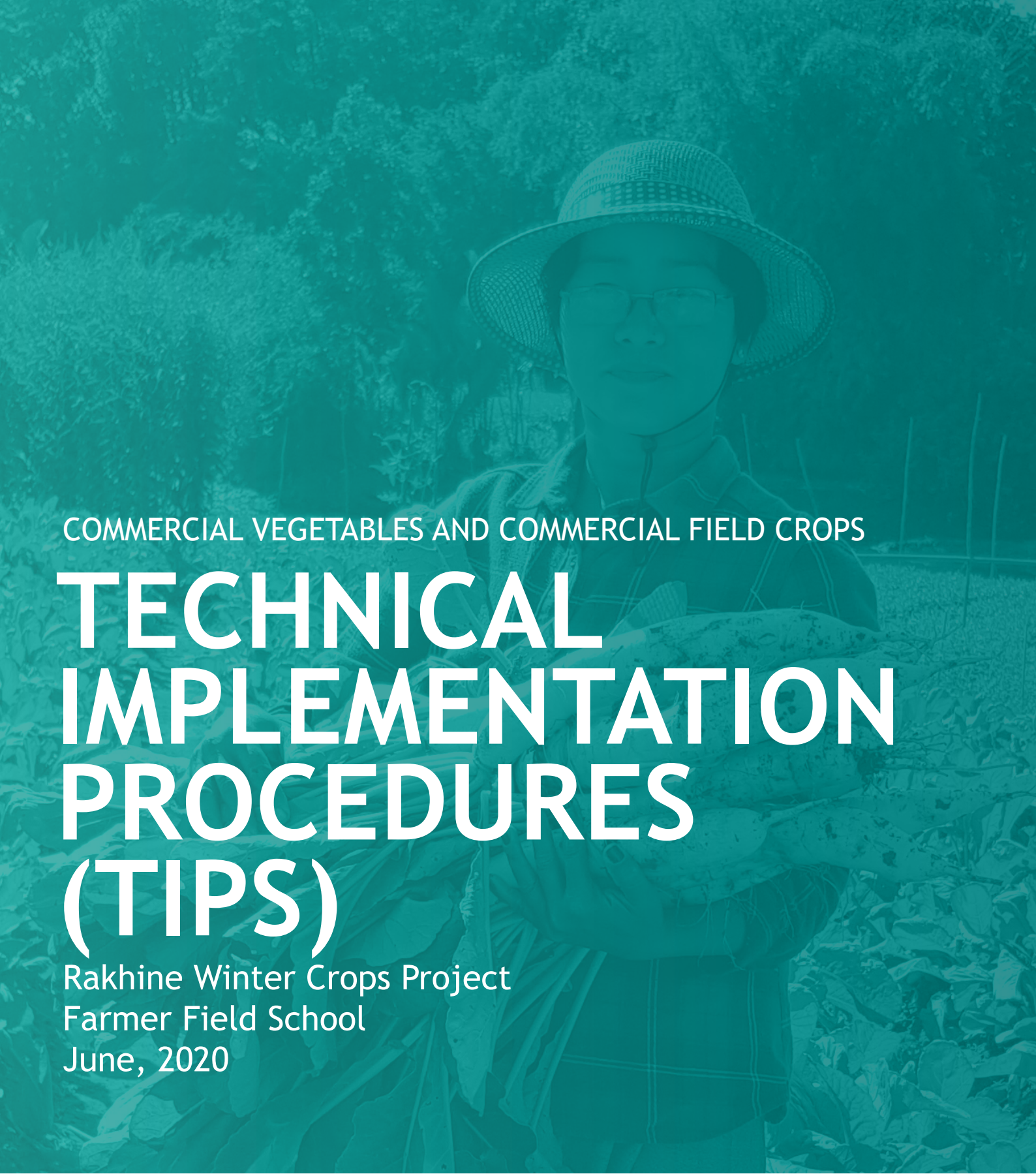


COMMERCIAL VEGETABLES AND COMMERCIAL FIELD CROPS

TECHNICAL IMPLEMENTATION PROCEDURES (TIPS)

Rakhine Winter Crops Project
Farmer Field School
June, 2020

RAKHINE WINTER CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme

Table of contents

Commercial Field Crops (1 acre)

Appendixes

Introduction

In cooperation with the Ministry of Agriculture, Irrigation and Livestock (MoALI), the Rakhine Winter Crops Project (RWCP) has been implementing a program aimed at the improvement of agricultural extension services by private and government sectors to improve the yields and income of farmers. These Crop Management Tips (CMTs) aim to guide Commercial Vegetable (CV) and Commercial Field Crop (CFC) Farmers to lift their standard of agriculture through adopting a commercial farming approach using Good Agriculture Practice (GAP). The MoALI and Agro dealers have been given these CMTs to help them to give advice on the appropriate use of inputs for sustainable agriculture, in this way strengthening extension services in the government and private sectors.

The beginning of the manual guides readers in selecting crops from different crop family groups for crop rotations, shows a crop calendar identifying when it is best to grow these crops, and gives an idea of the profit expected from each crop. The following CMTs then give guidelines for growing each crop in Rakhine State Myanmar. For those using the manual in other regions, users should check their soil type and other conditions and adjust recommendations to suit their situation. The project wishes you success in your farming enterprises in the future.

1. Crop Rotation:

Moving similar family crop groups from one location to a new location each year reduces disease, controls insect pests, improves soil and plant nutrition, and reduces risk.

Group - 1	Group – 2
1. Yard-long Bean	1. Chili
2. Okra	2. Tomato
3. Onion	3. Egg-plant
4. Carrot	4. White Egg-plant
	5. Coriander
Group – 3	**Group – 4**
1. Cabbage	1. Bottle Gourd
2. Cauliflower	2. Snake Gourd
3. Broccoli	3. Ridge Gourd
4. Radish	4. Bitter Gourd
5. Water spinach	5. Cucumber
6. Sweet Corn	6. Water Melon
7. Mustard	7. Pumpkin

2. Calendar of Crops to guide farmers to choose the timing of crops

Crops	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Group - 1												
1. Yard-long Bean												
2. Okra												
3. Onion												
4. Carrot												
Group – 2												
5. Chili												
6. Tomato												
7. Egg-plant												
8. White Egg-plant												
9. Coriander												
Group – 3												
10. Cabbage												
11. Cauliflower												
12. Broccoli												
13. Radish												
14. Water spinach												
15. Sweet Corn												
16. Mustard												
Group – 4												
17. Bottle Gourd												
18. Snake Gourd												
19. Ridge Gourd												
20. Bitter Gourd												
21. Cucumber												
22. Water Melon												
23. Pumpkin												
Other Crops												

Remark:

Good growing period

Difficult growing period

3. Expected Profits from Commercial Vegetable and Commercial Field Crops

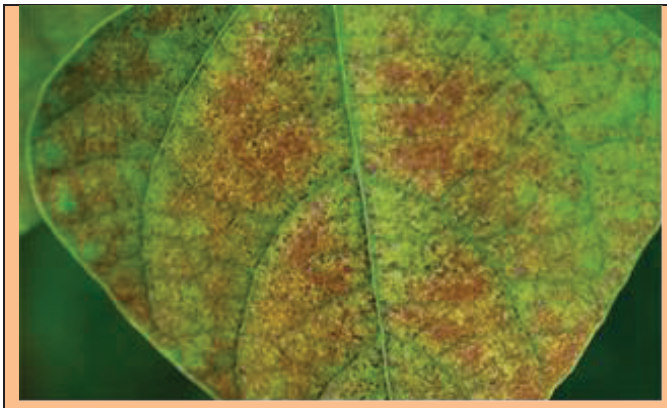
Crop Groups	Income	Expense	Profit/ Loss	Expenditure: Income Ratio	Profit/ Loss group
Group - 1					
1. Yard-long Bean	153000	59200	93800	2.58	4
2. Okra	145200	55700	89500	2.61	3
3. Onion	245000	82449	162552	2.97	2
4. Carrot	165000	50200	114800	3.29	1
Group - 2					
5. Chili	189900	50700	139200	3.75	3
6. Tomato	254000	55200	198800	4.60	1
7. Egg-plant	158400	48200	110200	3.29	4
8. White Egg-plant	140800	49200	91600	2.86	5
9. Coriander	220000	52000	168000	4.23	2
Group - 3					
10. Cabbage	174000	43450	130550	4.00	2
11. Cauliflower	174000	48925	125075	3.56	4
12. Broccoli	203000	53925	149075	3.76	3
13. Radish	132000	45775	86225	2.88	5
14. Water spinach	176000	36300	139700	4.85	1
15. Sweet Corn	159500	63600	95900	2.51	6
16. Mustard	105600	42200	63400	2.50	7
Group - 4					
17. Bottle Gourd	187000	40925	146075	4.57	2
18. Snake Gourd	153000	42625	110375	3.59	4
19. Ridge Gourd	162000	44925	117075	3.61	3
20. Bitter Gourd	130050	47625	82425	2.73	7
21. Cucumber	232320	50500	181820	4.60	1
22. Water Melon	150000	53875	96125	2.78	6
23. Pumpkin	204800	59050	145750	3.47	5
Average CV (0.06 acre)	174547	51154	123392	3.5	
Field Crop Group					
24. Sweet corn (Field Crop)	1393920	506400	887520	2.75	4
25. Ground nut (Field Crop)	600000	295913	304087	2.03	5
26. Chili (Field Crop)	2439500	488700	1950800	4.99	1
27. Onion (Field Crop)	2450000	538170	1911830	4.55	2
28. Watermelon (Field Crop)	2613600	649700	1963900	4.02	3
Average CFC (1 acre)	1899404	495777	1403627	3.7	

Yard Long Bean Crop Management Tip		
Crop Variety Selection	Choose a variety with a good market, good yield' high resistance to mosaic and rust diseases. (eg. Akaril 11, Fola and 844)	
Season preference	Can be grown in winter, summer and monsoon season.	
Crop Duration	First harvest 45 days from planting until up to 70 days.	
Yield Expectation	Average yield 1,800 bunches / 0.06 acre (one bunch=10 Pods)	
Seed requirement	2 tins (800 seeds/tin) / 0.06 acre or 2 packs (700 seeds /pack), 726 plants per 0.06 ac	
Site selection	Prefers soils that are loose and friable without too much nitrogen	
pH	Prefers 6.7 but tolerates 5.5 to 7.5.	
Irrigation	Furrow irrigation should be used for large areas. Drip or hand watering should be used for small areas. Sprinklers can cause leaf diseases. Yard long bean cannot tolerate drought so must not be allowed to dry out. Young Plants need less water than older plants. Save water and labor by using drip, or shower rose in between plant rows on the top of beds. Furrow irrigation between beds wastes water and encourages weeds and leaf disease. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 Month before planting	**Land Preparation:** Deep plough 9-12 inches and 2-3 harrows should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (see appendix for details)	Keep Bokashi moist
	Nursery preparation: No need to prepare nursery for Yard Long Bean. Direct seeding is preferred.	
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide, 1.5 feet between rows. The advantage of raise bed are; (1) Good drainage, (2) Good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil. **Row making and plant spacing:** Plant seedlings in rows 1.5 feet apart and 1.5 feet spacing between the plants in a zig-zag pattern, with 6 inches left on each side of the beds. Soak seeds in water one day before seeding. If Rhizobium is used, the seed should be kept in dark conditions.	Moist soil enhances easier bed preparation.

1 week before planting	**Basal fertilizer:** Mix 6 viss of compound 15:15:15/ 0.06 acre in a 10" x 6" trench and mix into the soil along the planting row, together with the Bokashi compost 37-74 viss/0.06 ac.	2 days before transplanting, moisten the soil for easy digging and water for young plants at transplanting as necessary.
	Digging holes: Dig holes about 6" in diameter and 6" in depth. Pour 40 ml of Trichoderma solution (7gm / 10 liters) into each hole 2 days before transplanting.	
	Mulching: Mulch with rice straw 6" thick or plastic sheet on the raised beds to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch as this can cause disease.	
Planting Techniques	**Direct seeding:** Depth of planting seeds (one seed per one hole) should be 2 times the seed diameter.	Lightly water plants immediately after transplanting.
1 Week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** When plant height reaches 12 inches, use 6 feet high trellis made from bamboo or trellis net. (see photo below)	Pour water 1 liter per plant every second day
2-4 weeks after planting	**Pruning:** Pruning in some varieties like FOLA (EW) should be done when the plant reaches 2-3 feet in height, while it is not required for 844 variety. No need side shoot removal. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem extract every week. If this does not work well, use chemical control measures as a last option (see photos below)**.** **Supplementary fertilizer:** Potassium nitrate (KNO_3) should be applied thoroughly on the leaves starting from flowering time to harvest, at the rate of 10 ticals per 4 gallons of water.	Pour water 2 liters per plant every second day
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench 6 inches from the base of the plant along the whole bed row and add the fertilizer. Apply Bitter Salt (2 viss / 0.06 ac) to water: 1 teaspoonful per plant and 15: 15: 15 compound fertilizer (6 viss/0.06ac) 1 tablespoonful per plant. For plastic mulch, make a hole equally between plants to insert the supplementary fertilizer.	Pour water 2-3 liters per plant every second day
6-9 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (6	Pour water 4-6 liters per plant every second day,

	viss/0.06 ac) with 1 tablespoonful (about 10 g) per plant, in a 2" x 2" trench 1' away from the base of the plant because the roots are spread wider than before.	especially after applying fertilizer.
Bamboo & Trellis	 Bamboo trellis  Trellis net	
Pest & Diseases Control	**Chemical & Organic Options:** Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If the infected plants could not be controlled with organic measures, please use chemical control measures.	

Description	Control measure
• Yellow or rust powder seating on the lower surface of leave. (Photo 1)	• Apply Macozeb at 10 day interval
• Larva attack leave, bud, flower by circling with its exudates and then bores the pod and then to seed. (Photo 2)	• Spray with systemic insecticide as soon as insect infection. eg; Imidacloprid
• Yellow mosaic symptom observed on the leaves can be caused by a virus which is transmitted by sucking insect. (Photo 3)	• Cooking Oil & soap spray and Abamectin
• Light green mottled areas, stunted growth; aphids transmit virus diseases (Photo 4).	• Use Abamectin following label instructions
• Grey or white powdery scattering on the leaf surface, petiole and pod. (Photo-5)	• Apply Sulphur dust 1.5 lb/0.06 acre.



1. Rust

2. Pod borer damage

3. Bean Yellow Mosaic

4. Aphid colonies

5. Bean Powdery Mildew

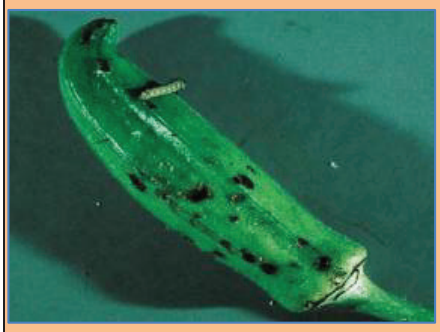
Harvesting	Start harvesting at 45-50 days after transplanting. Pick up the fruits at 4-5 days interval regularly. Leaving fruit on the vine will be slow down the plant growth and reduce the crop yield. Harvest in cool temperatures and store in the shade.
Quality Tips	Maintain soil moisture and plant nutrients. Trellising prevents blemishes and rots. Take care to prevent damage during storage. Harvest to meet market needs. For tender beans a good length is 14” – 18”.

Okra Crop Management Tips		
Crop Variety Selection	Choose a hybrid (eg. Basanti -447, Kirti 014, Akri 123) and adapted local varieties with disease resistance and market demand.	
Season preference	Okra can grow the whole year.	
Crop Duration	50-55 days to first harvest from seeding and can continue harvesting 2 months more.	
Yield expectation	Average yield 14,520 fruits (3,630bunches of 4 fruits/bunch) / 0.06 acre	
Seed requirement	4 packs (250 seeds/pack); 726 plants per 0.06 acre	
Site selection	Okra will tolerate a wide range of soil types but needs to be well drained. They preferred light soil.	
pH	Prefers 6 - 6.8	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinklers will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds wastes water and encourages weeds and leaf diseases. **Fertigation:** Can be used when using drip irrigation.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep plough 9-12 inches and 2-3 times harrowing should be done. Okra has a tap root and a very strong root system.	Damp soil is easier to cultivate
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition (guidelines in appendix)	Keep Bokashi moist
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years. **Nursery preparation:** No need to prepare nursery for Okra as it is direct seeded into the field.	Water every morning as necessary
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 1.5 feet apart. The advantage of raised beds are as follows: (1) good drainage, (2) good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil. **Row making and plant spacing:** Plant seeds in rows 2 feet apart and 1.5 feet spacing between the plants in a zig-zag pattern with 6 inches left on the edges of the beds.	Moist soil enhances easier bed preparation.

1 week before planting	**Basal fertilizer:** Mix 6 viss of compound 15:15:15 per 0.06 acre in 10" x 6" trench and mix into the soil, together with the Bokashi compost 37 viss per 0.06 ac. **Digging holes:** Dig plant holes about 6" in diameter and 6" in depth. Pour half tin of Trichoderma solution (7gm / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch as it might cause pant disease.	
Planting Techniques	**Direct seeding:** Depth of planting seeds (one seed per one hole) should be 2 times their diameter.	Pour water into the holes immediately after seedling
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** No need for trellising	2 liters per plant every second day
2-4 weeks after planting	**Pruning:** Cut the lower leaves. (see photo) **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem extract every week. If this does not work well, use chemical control measures as a last option (see photos below)	Apply 3.5 - 4 liters water per plant every second day.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench 6 inches from the base of the plant along the whole bed row. Add bitter salt (2 viss/ 0.06 ac) to water: 1 teaspoon per plant. Apply 15: 15: 15 compound fertilizer (6 viss) 1 tablespoon per plant. For plastic mulch, make a hole equally between plants to insert the supplementary fertilizer. Apply Potassium nitrate (KNO_3) thoroughly on the leaves starting from flowering time to throughout the fruit growth, at the rate of 10 ticals per 4 gallons of water 2-4 times in the morning.	Apply 3.5 - 4 liters water per plant every second day.
6-9 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (6 viss/0.06 ac) with 1 tablespoonful (about 10 g) mid-way between plants because the roots are spread wider than before.	After fertilization application, apply –4-6 liters water per plant.
Pest & Diseases Control	**Chemical & Organic Options:**	

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If the infected plants could not be controlled by organic control measures, please use chemical control measures.

Description	Control measure
• Corn Ear Worn (photo 1) • Jassids (Photo-2) • Yellow Mosaic (photo 3) • Leaf Spot (Photo 4) • White powdery coating on leaves (photo 5).	• Remove caterpillars by hand. • Use imidacloprid or neem extract to control whitefly. • Keep field clean: crop rotation • Spray Chlorothalonil; Carbendazin, macozeb



1. *Corn Ear Worn*

2. Jassid affect to Okra

3. Yellow mosaic

Photo-4 Leaf spot

Photo-5 Powdery Mildew

Harvesting	Okra fruit grows very quickly. It is important to harvest every 2 days in the winter season and every day in the hot summer season. Pick fruits starting from 1 week after flowering or 4-6 days after fruits setting. Fruits can be harvested continuously for 2 months. Fruits can be harvested at 3 -3.5 inches long.
Quality Tips	Okra that is over mature is stringy. Only harvest okra that is young with no yellowing. The tip should break off with a snap.

Onion Crop Management Tips		
Variety selection	Select market demanded and disease resistance varieties. Suitable local varieties that are most popular are Shwe Pha Lar local variety, Baung Zauk local variety, Nasik red F-1 Indian variety.	
Season Preference	Onions can grow well from late monsoon to winter (September to December). Dry season is more preferred for harvesting.	
Crop duration	90-150 days after transplanting.	
Expected Yield	165 viss per 0.06 ac.	
pH	Prefer 6 - 7 range	
Seed requirement	2 tins/ 0.06 ac, 9,900 plants/0.06 ac	
Site selection	Onions can be grown in most types of soil. It does not like water logging. Sandy loam soil with good drainage is the best.	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand watering. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. (4) Watering should be reduced just before harvesting to hasten maturity. Onions have small root systems and need regular watering. It is critical that plants do not dry out during bulb enlargement. For bulb onions stop watering when the tops begin to fall. **Fertigation:** Can be used when using drip.	
Time for operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before transplanting:	**Land preparation:** Plough the soil to 9-12 inches depth. Harrow 2-3 times to get well pulverized soil because of shallow rooted system. **Liming**: Add lime 13 viss/0.06 ac/year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
	Nursery establishment: Well decomposed cow-dung (2-4 baskets): burnt rice husk (2-4 baskets) and loamy soil (1-2 baskets) should be mixed with compound 15:15:15 (0.5 viss) and applied thoroughly on 30 % shaded bed (3' width x 50' length). Gently compact the bed soil and level evenly. Onion seeds are broadcasted evenly on the bed and covered with sand (or) burnt rice husk and water. Seedlings are ready to transplant after 25-45 days after sowing. It needs 0.05 ac of nursery area for 1 acre (11 x 50ft x 3 ft beds)	Water nursery every morning as necessary.

1-2 weeks before planting	**Raised bed preparation**: Make raised beds (3 feet width and 6-8 inches in height 1.5 feet apart). The advantage of raised beds are as follows: (1) good drainage, (2) good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil.	2 days before transplanting , moisten the soil for easy digging and
	Basal fertilizer: Add 6 viss of 15:15:15 compound fertilizer, Bokashi compost about 37-74 viss and 8viss of gypsum per 0.06 acre. **Making row spacing:** With a rake 6" width and 1" depth make lines for transplanting.	for water for young plants at transplanting as necessary.
Planting Techniques	**Seedlings:** On the prepared lines, seedlings are transplanted with 4" between plants and 6" between rows spacing. The depth needs to be about 1".	Lightly water the plants immediately after transplanting
1 week after planting	**Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as this may cause stem disease. **Thinning or infilling:** Not need for thinning as planting 1 pant per hole. Infilling should be done.	Water every 2nd day 1 liter per foot of bed.
2-4 weeks after planting	**Pruning:** No need to prune. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem weekly. If this does not work well, use chemical control measures as a last option (see photos below)	Water every 2nd day 1 liter per foot of bed
5-6 weeks after planting:	**Weeding:** 4-8 weeks after transplanting is critical time for weeding. **Foliar fertilizer:** Apply Potassium Nitrate (KNO3) in the morning at a rate of 10 ticals/4 gallon (20 ticals/0.06ac). **Pest & Disease control:** If infected symptoms are found, effectively control on time following the directions below.	Water every week 3 liters per foot of bed.
7-8 weeks after planting	**Weeding:** 4-8 weeks after transplanting is critical time for weeding. **Supplementary fertilizer:** Make 2" x 2" trench between rows and apply 9:25:25 compound fertilizer (3.5 viss/0.06 ac), in week 7 apply gypsum (8 viss/0.06 ac); apply sulfur coated urea (8 viss/0.06 ac) and in week 8 potash fertilizer (3.5 viss/0.06 ac) to improve bulb quality and prolong shelf life. **Foliar fertilizer:** Apply Potassium Nitrate (KNO3) in the morning with the rate of 10 ticals/4 gallons (20 ticals/0.06ac). **Pest & Disease control:** If infected symptoms are found, effectively control on time following the directions below.	Water every week 3 liters per foot of bed.

<table>
<tr><td>9-14 weeks after planting</td><td>Weeding: As required.
Pest & Disease control: If infected symptoms are found, effectively control on time as described below.</td><td>Water every week 3 liters per foot of bed..</td></tr>
<tr><td>15 weeks after transplanting to harvesting</td><td>Weeding: As needed
Pest and disease control: When needed – see details below.</td><td>Reduce watering to 1 liter per 1 foot of bed per week. Stop watering 15 days before harvesting.</td></tr>
<tr><td>Pests and diseases control</td><td colspan="2">Chemical & Organic Options:
Inspect pests and diseases symptoms regularly. For prevention, use organic methods like EM 5 and Neem weekly. If this does not work well, use chemical control measures as a last option.
<table>
<tr><th>Description</th><th>Control measure</th></tr>
<tr><td>• Thrips and damage symptoms (Photo No. 1)
• Leaf miner. (Photo No. 2)</td><td>• Chlorantraniliprole (Prevathon) .
• Imidacloprid (Doza), Abametin (Demon),</td></tr>
<tr><td>• Purple blotch fungal disease (Photo No. 3)
• Botrytis bulb rot fungal disease (Photo No-4)</td><td>• Apply potash. Use Iprodione (Rovral) Azoxystrobin+Difenoconazole (Unity).
• Avoid using over urea fertilizer. Spray chlorothalonil, unity at 10 days interval.
• Use resistance varieties. Eradicate diseased plants and apply crop rotation.
• Try to be good ventilation between plants.</td></tr>
</table></td></tr>
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Thrips and damage symptoms (Photo No. 1)

Leaf miner. (Photo No. 2)

1. Purple blotch fungal disease

4. Botrytis bulb rot fungal disease

Harvesting	When two thirds of the leaves fall down, can start harvesting. Watering should be cut before harvesting to hasten maturity.
Quality guidelines	Take care not to damage bulb during storage. Storage house should have a high roof and be a well ventilated place. Storage depth of onions should not be more than 6" thick. Thicker may trap moisture and cause disease.

Carrot Crop Management Tips		
Crop Variety Selection	Select varieties which resist to pest and disease. Use certified seed treated with thiram and marketable varieties. Eg. EW-Chike (F1).	
Season preference	Carrot can grow well in winter season (Sept-Nov planting).	
Crop Duration	70-100 days after sowing.	
Yield Expectation	Average yield about 5,500 carrots per 0.06 acre	
Seed requirement	1 tin (250g /tin). 6,600 plants per 0.06 acre	
Site selection	Carrots prefer light well drained soils with high organic matter.	
pH	Prefer 6.5-7.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. Irrigation: (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. **Fertigation:** Can be used when using drip	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to 9" - 12" and 2-3 times harrowing should be done. **Liming**: Lime 13 viss/0.06 ac. 3 years consecutively.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. - (guidelines in appendix)	Keep Bokashi moist
1 Week before planting	**Raised Bed Preparation:** Build raised beds 8-12 inches high, 3 feet wide and 1.5 feet between beds. Advantages of raised beds: 1) Good drainage, 2) Good ventilation for the soil, 3) Easy for root to penetrate the soil, 4) furrow irrigation, 5) greater than soil moisture, and greater than organic material in soil. **Row and Plant Spacing:** row spacing 8 inches & plant spacing 4 inches **Basel fertilizer application:** Apply in a trench 6" x 6" along rows in the raised bed. a Mix compound 9:25:25 fertilizer (12 viss) and Bokashi compost (37-74viss) for 0.06 acre after raised bed preparation time. Use well composted manure (not well decomposed manure may cause small root hairs so may reduce market demand). **Spread Trichoderma** solution (7g/10 liter) along planting lines in raised beds 2 days before sowing. **Nursery:** No need to make nursery. **Digging the hole:** No need to dig holes**.**	Moisture soil makes land preparation easier. Keep moist 2 days before sowing.

Planting Techniques	**Direct seeding:** Carrots seed should be directly planted into rows in the field. **Spacing:** row spacing 8 inches & plant spacing 2 inches. **Direct seeding:** Depth of planting seeds should be very shallow at 2 times the seed diameter. Because the seeds are so small, mix them with sand. Lightly spread the mixture of sand and seeds along the shallow line and slightly cover with soil. **Mulching**: To prevent weeds, reduce soil temperature, to prevent soil disease spreading to the fruit and prevent erosion mulch the beds with straw or plastic mulch.	In the evening, watering the raised beds before sowing. Don't water after sowing. Seeds may be washed out with watering as they are very shallow in the ground.
1-2 weeks after planting	**Thinning :** When emergences is completed, thinning is required to get one healthy plant per 2 inches **Trellising:** No need to trellis. **Pruning:** No need to prune. **Weeding**: Remove weeds to prevent nutrient competition and host for pests and diseases. **Pest and Disease Control:** Spray EM 5 or Neem extract pesticide at 1 week intervals. As the last option, use chemical.	Watering 8 liters per meter bed at 1 day intervals.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Foliar spray:** Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06ac at the rate of 1 teaspoon/Liter and apply through the whole of the raised beds. **Fertigation** can be used using drip	Watering 12 liters per meter at 1 day intervals.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Watering 14 liters per meter bed at 1 day intervals.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Foliar spray:** Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06ac at the rate of 1 teaspoon/Liter and apply through the whole of the raised beds.	Watering 16 liters per meter bed at 1 day intervals.
6-14 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Watering 16 liters per meter at 1 day interval.

Pest & Diseases Control

Chemical & Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, please use chemical control measures.

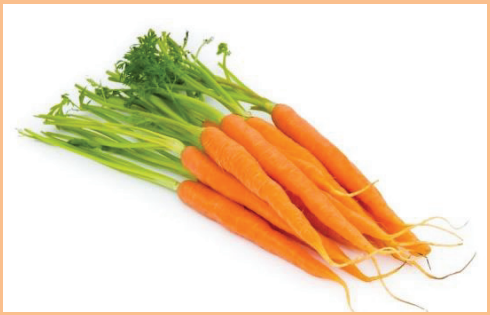
Description	Control measure
• Carrot Fly damage (photo 1) • Nematode (photo 2) • Bacterial soft rot (photo 3) • Alternaria leave spot (photo 4)	• Rotate crops, Apply Cyclone. • Rotate crops • Use recommended varieties, practice crop rotation. Used copper base bactericide. • Rotate crops and apply unity.

- Carrot Fly damage

2. Nematode

3. Bacterial soft rot

Alternaria leave spot

Harvesting	After harvesting, clean the soil off the carrot. Cut the leaves to leave a short stem.  
Quality Tips	Maintain soil moisture and plant nutrients. Don't watering for 2 weeks before harvest to get delicious roots. . Avoid pliantly behind peanut and root crops such as sweet potato and radish.

Chili Crop Management Tips		
Crop Variety selection	Select market demanded varieties. If hybrid varieties are used, study their resistance to nematode and anthracnose. Suitable hybrid varieties are Demon and Tongla- 692. Local varieties are usually more popular with local consumers.	
Season Preference	In dryer season, yield is increased and disease infection reduced.	
Crop Duration	First harvesting of Tongla and Demon varieties can start 50-55 days after transplanting. Depending upon the soil fertility, harvesting can extend 5-6 month after transplanting.	
Yield expectation	Average plant population is for hybrid varieties is 352 plants/ 0.06 ac with an average yield of 211 viss (green)/ 0.06 ac and 53 viss (dry)/0.06 ac Local varieties have 726 plants/ 0.06 ac with an average yield of 108 viss (green)/ 0.06 ac.	
pH	Prefers 5 - 5.7	
Seed requirement	1 pack per 0.06 ac (5 g) for both Tongla and Demon. Local varieties require 1tickle per 0.06 acre.	
Site selection	Although chili thrives well in wide variety of soils, it does not like water logging. Sandy loam soil with good drainage is the best.	
Irrigation	Growing chilies need sufficient water because they are not tolerant to drought. Gradually increase watering from planting to fruit set and enlargement. Use furrow irrigation in large field, and use pouring water or drip irrigation for small farm. Sprinkler irrigation may promote leaf and fruit diseases. **Fertigation:** Can be used when using drip.	
Time of operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting:	**Land preparing:** Plough the soil to 9-12 inches because of deep the rooted system of chili. Harrow 3-4 times to get well pulverized soil.	Moist soil enhances easier bed preparation
	Liming: If soil pH is less than 6, add lime 13 viss/ 0.06 ac/ year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition.(guidelines in appendix)	Keep Bokashi moist
3 Weeks before planting:	**Nursery preparation**: Use nursery seed trays (105 hole) or seedling bags. (Put the rooting media mixed by the ratio of 1: 1 : 1 of garden soil, well decomposed cow dung and burnt rice husk ash).(guidelines in appendix)	Irrigate or pour water daily in the morning.

1 Week before planting	**Raised bed preparation**: Make raised beds 3 feet width and 1 feet in height and 2 feet apart. **Row making and plant spacing:** On the beds, make 2 rows, 2 feet apart and 6" to the outside of the bed. The advantage of raised beds are as follows: (1) good drainage, (2) good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil. **Basal fertilizer:** Add 6 viss of 15:15:15 compound fertilizer and bokashi compost about 37-74 viss per 0.06 acre in a 10" x 6" trench line along the planting row. Mark plant holes 3 feet apart along the rows. Pour half tin (7 gm/ 10 Lit) of Trichoderma solution 2 days before transplanting into plant holes. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch as this may cause stem disease.	2 days before transplanting, moisten the soil for easy digging and water for young plants at transplanting as necessary.
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes peeking the seedling at ground level. If you plant below ground level, the hole will fill with water causing less aeration and possibly stem disease. **Direct seeding :** Direct seeding technique is not suitable for chili.	Lightly water the plants immediately after transplanting.
1 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. **Thinning or infilling:** Infill to get 1 strong plant per hole.	Pour 1 liter of water per plant every second day, pour more water if the soil is dry.
2-4 weeks after planting	**Pruning:** Remove the first set fruit so it does not weaken the plant. Cut the suckers under the first truss. **Weeding:** Weeding should be done regularly. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)	Pour 2 liters of water per plant every second day

<table>
<tr><td>5-6 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.
Supplementary fertilizer: Dig a small 2" x 2" trench 3" from the base of the plant along the whole bed row. Apply Epsom Salt (Magnesium Sulphate -MgSO4) at the rate of 1 teaspoonful per plant (2 viss per 0.06 ac). Also apply 4.5 viss of 15:15:15 compound fertilizer at the rate of 2 tablespoonful per plant in the trench.
Foliar fertilizer: Dissolve two ticals of Potassium Nitrate (KNO3) in 4 gallons of water per 0.06 ac and spray on the leaves in the morning. (20 tical/0.06) acre
Pest & Disease control: For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)</td><td>Pour 2 liters of water per plant every second day. Provide more water if the soil is dry.</td></tr>
<tr><td>7-9 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.
Pest & Disease control: For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)</td><td>Pour 1 liter of water per plant daily.</td></tr>
<tr><td>10-16 Weeks after planting</td><td>Weeding: As required, preferably controlled by hand.
Supplementary fertilizer: Apply 4.5 viss of 15:15:15 compound fertilizer at the rate of 1 tablespoonful per plant in a small 2” x 2” trench 8” distance from the base of the plant.
Pest & Disease control: Control when required.</td><td>Pour 2 liters of water per plant daily.</td></tr>
<tr><td>Pests and diseases</td><td colspan="2">Chemical & Organic Options:
Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. Firstly, the infected plants should be removed by hand or use organic control measures. If this does not work well, chemical control measures could be used.

<table>
<tr><th>Description</th><th>Control measure</th></tr>
<tr><td>• Sucking insect (Thrips, Aphid) (Photo No. 1)
• Fruit Fly (Photo No. 2)</td><td>• Spray neem extract or EM 5 solution for prevention weekly interval. Spray Imidachlorprit, Doza, Abametic (Demon), Chlorantraniliprole, Prevathon or Alan insecticide</td></tr>
<tr><td>• Anthracnose (Photo No. 3)
• Leaf spot diseases. (Photo No. 4)
• Leaf curl virus disease (Photo No. 5)

• Mosaic virus disease (Photo No. 6)</td><td>• Spray Metalaxyl, Asoxystrobin, Diphenoconazole-Unity
• Use the seed of resistance variety .Remove the infected plants. Use the crop rotation
• (To reduce pests and diseases infestion, use potassium fertilizer, resistance variety, clean the infected plants and burnt, crop rotation and do a good ventilation for plants)</td></tr>
</table></td></tr>
</table>

1. Thrips

2. White Fly

3. Anthracnose

4. Leaf spot

5. Leaf curl virus disease

6. Mosaic virus disease

Harvesting	Depending upon the market, chili can be harvested green or red weekly in the early morning. Avoid harvesting chili in moist conditions as this may attract disease. Pick the fruits with short stem (petiole) still attached.
Quality Tips	Late application of Nitrogen prolongs vegetative growth. Excess irrigation at ripening stage may lead to rotten fruit.

Tomato Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties (locally adapted varieties or hybrids such as Nirvana, Platinum 701 , Glory 289 , LORA 909)	
Season preference	Tomatoes require a high level of care. They can grow the whole year, however in the rainy season they may get more leaf diseases.	
Crop Duration	Start harvest 50-95 days after transplanting. **Note:** Most of tomatoes have long term duration, however, "cherry" tomatoes has short term duration and mature quickly.	
Yield Expectation	Average yield 508 viss / 0.06 acre	
Seed Requirement	1 pack (5g / pack), 726 plants / 0.06 acre	
Site selection	Tomatoes like light well drained soils with high organic matter	
pH	Prefers 6-6.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds wastes water and encourages weeds and leaf diseases. Regular water is needed during flowering, fruit set, and fruit enlargement. More water may be needed for un-mulched plants. Older late-maturing varieties may require less water near harvest. Uneven watering while the fruit is developing may cause splitting. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep plough at 9 - 12 inches and 2-3 harrows should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition (guidelines in appendix)	Keep Bokashi moist
	Nursery Preparation: Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at the ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 21 days old and about 4 inches high or have 4-5 leaves.	Water every morning for moist soil for seedlings as necessary
1 week before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 1.5 feet apart. The advantages of raised bed are as follows; (1) good drainage, (2) good soil aeration, (3) easy root	

	penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil.	
	Row making and plant spacing: In the internal beds have 2 rows 1.5 feet apart. In the outside bed only 1 row in the center of the bed. Mark plant holes with zig-zag pattern 1.5 feet apart along rows.	Moist soil enhances easier bed preparation.
	Basal fertilizer: Mix 6 viss /0.06 acre of 15:15:15 compound fertilizer, 37-74 viss/0.06 ac of Bokashi compost, and mix in a 10" x 6" trench along the planting rows.	
	Digging holes: Dig holes about 6" in diameter and 6" in depth. Pour a half tin of Trichoderma solution (7g / 10 liters) into each hole 2 days before transplanting.	2 days before transplanting, moisten the soil for easy digging and water for young plants at transplanting as necessary
	Mulching: Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as this may cause disease.	
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Direct seedling is not suitable for tomato plants.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Staking:** Staking should be done using bamboo sticks (1 stake per plant). String the plant with plastic string when the plant height reaches about 12 inches.	Pour water 1 liter per plant every second day
2 weeks after planting	**Pruning/Suckering:** Remove side shoots (suckers) below the first or second truss. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem. If this does not work well, use chemical control measures as a last option (see photos below).	Pour water 2 liters per plant every second day
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at the rate of 1 teaspoonful per plant (2 viss per 0.06 ac). Apply 15:15:15 compound fertilizer (4.5 viss per 0.06 ac) with 1 tablespoonful (about 10 g) per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 2 liters per plant every second day
4 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Spray Potassium Nitrate (KNO3) – 0.4 viss in water solution for 0.06 acres at a concentration of 10 ticals per 4 gallons of water. Starting from flowering, 2- 4 times in the morning.	Pour water 2 liters per plant every second day
5 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Pour water 3 liters per plant every second day

	Supplementary fertilizer: Dig a small 2" x 2" trench **10"** from the base of the plant along the whole bed row. Apply Epsom Salt (Magnesium sulphate-$MgSO_4$) at 2 viss per 0.06 ac and apply at the rate of 1 teaspoonful per plant.	
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply Potassium Nitrate (KNO_3) solution at the concentration of 1 to 4 percent (10 ticals per 4 gallons of water) in the morning.	Pour water 3 liters per plant every second day after fertilization
Pest & Diseases Control	**Chemical and Organic Options:** Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, please use chemical control measures. **Description** • Early Blight (Photo 1) • Thrip Damage causes Tomato Mosaic Virus-TMV (Photo 2) • Late Blight (photo 3) • Bacterial Wilt (Photo 4) **Control measure** • Copper Oxychloride+ Mancozeb • Imidacloprid spray + Neem spray • Apply Azoxystrobin + Difenoconazole • Crop rotation (non Solanaceae plant) 4 years and remove plant and burn it. Apply Copper Hydroxide + Kasugamycin spray	

1. Early Blight

2. Thrips damage cause TMV

 **3. Late Blight**	 **4. Bacterial Wilt**
Harvesting	Harvesting tomatoes depends on the market. If the market is close, pick the fruit with red color. If transported and stored for long distance, pick the fruit with pale green or pink color.
Quality Tips	Uneven watering can cause cracking in fruit setting. Take care to prevent damage during storage.

Dark Eggplant Crop Management Tips		
Crop Variety Selection	Select erect short or long duration variety with good markets and high yield. Eg. F1 (Runako, Grand cluster - long purple blue, Kermit – green color). Local variety (white purple, purple ball, oblong shape)	
Season preference	Eggplant will have heavier crops and less disease during the dry season. They can grow well everywhere except very cool hilly regions.	
Crop Duration	45 days after transplanting to first harvest and continue harvesting up to 90 days. **Note:** This depends on the variety.	
Yield Expectation	Average yield 1,056 bunches/0.06 acre.	
Seed	1 pack (5g /pkt), 352 plants per 0.06 acre	
Site selection	Egg Plant will tolerate a wide range of soil types but needs to be well drained.	
pH	Prefers 5.5-6.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler may cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plant rows on top of beds, (3) Furrow irrigation between beds wastes water and encourage weeds and leaf diseases. Gradually increase water from transplanting to early fruit formation. As fruit begins to ripen watering needs to be regular. **Fertigation:** Can be used when using drip.	

Time for Operation	General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)	Watering
1 month before planting	**Land Preparation:** Deep ploughing to 9-12 inches and 3-4 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac/year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist.
	Nursery Preparation: Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting when they are 21 days old.	Water every morning for moist soil for seedlings as necessary
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 1.5 feet apart. Advantages of raised beds are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and greater organic material in soil.	
	Row making and plant spacing: Plant seedlings in rows 2 feet apart and 2 feet spacing between the plants in a zig-zag pattern.	Moist soil enhances easier bed preparation.

1 week before planting	**Basal fertilizer:** Apply 6 viss /0.06 ac of 15:15:15 compound fertilizer and the bokashi compost about 37-74 viss/0.06 ac into a 10" x 6" trench along the rows and mix in the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 150 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as this may cause disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Direct seedling is not suitable for eggplant.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** If necessary, stake plants with bamboo to prevent lodging. Staking improves fruit quality and yield.	Pour water 1 liter per plant every second day.
2-4 weeks after planting	**Pruning:** Remove side shoots below first or second truss. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem extract solution every week. If this does not work well, use chemical control measures as a last option (see photos below).	Pour water 2 liters per plant every second day.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply Epsom Salt (Magnesium sulphate - $MgSO_4$) at 2 viss/0.06 ac at the rate of 1 teaspoonful per plant. Apply 9:25:25 compound fertilizer (6 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant.	Gradually increase water from transplanting to early fruit formation, as the plant develops.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply Potassium Nitrate (KNO3) in the morning with the rate of 10 ticals per 4 gallons of water, 2 - 4 times during crop development.	Pour water 2 liters per plant every second day.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06acre rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters / plant every second day.
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply 0.4 viss/0.06ac of Potassium Nitrate (KNO3) in the morning at a rate of 10 ticals per 4 gallons of water.	Pour water 3 liters per plant after fertilization

Pest & Diseases Control	**Chemical and Organic Options:** Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If the infected plants could not be controlled by organic control measures, use chemical control measures.

Description	Control measure
• Shoot borer (Photo 1)	• Spray neem extract pesticide. Trade name - Prevathon (Chlorantraniliprole) or Alan.
• White fly (Photo 2) • Leaf Spot (Photo 3).	• Spray Trade name – Dozar 70 WP • Spray Trade name – Unity
• Bacterial Wilt (Photo 4)	• Remove infected plants and burn it: rotate crops. Spray Karsumin plus copper.

1. Shoot Borer

2. White fly

3. Tomato Mosaic Virus

4. Bacterial Wilt

Harvesting	Harvesting can be done depending on fruit shape and market. Fruits can be harvested 25-40 days after flowering begins. To ripen watering needs to be regular.
Quality Tips	Harvest regularly. Over mature fruit is bitter.

White Eggplant Crop Management Tips		
Crop Variety Selection	Different varieties have different colors and shapes and tastes. Choose those suited to your local market. Eg. F1 (Pale Phyu - EW). Local variety (white eggplant - purple, green and white)	
Season preference	White eggplant has more and less disease during the dry season	
Crop Duration	Start harvest 50-60 days after transplanting	
Yield Expectation	Average yield 17,600 fruits per 0.06 acre.	
Seed	5 pack (1g /pack), 352 plants per 0.06 acre	
Site selection	White eggplant will tolerate a wide range of soil types but needs to be well drained. It prefers sandy loam soils.	
pH	Prefers 5.5 - 6.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand watering. Sprinklers may cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Gradually increase water from transplanting to early fruit formation. As fruit begins to ripen, watering needs to be regular. **Fertigation:** Can be used when using drip (guidelines in appendix)	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep ploughing (9-12 inches) and 2-3 harrowing should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition (guidelines in appendix)	Keep Bokashi moist
	Nursery Preparation: Use a 105hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 21 days old and about 4 inches high, or have 4-5 leaves.	Water every morning for moist soil for seedlings as necessary

1 week before planting	**Raised Bed Preparation:** Dig raised beds 9 - 12 inches high, 3 feet wide and 1.5 feet apart. Advantages of raised beds are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and greater organic material in soil.	Keep Bokashi moist.
	Row making and plant spacing: Plant seedlings in rows 2 feet apart and 2 feet spacing between the plants in a zig-zag pattern. Dig the holes about 6" in diameter and 6" in depth. **Basal fertilizer:** Apply 6 viss /0.06 ac of 15:15:15 compound fertilizer with the bokashi compost about 37-74 viss/0.06 ac and then mix into a 10" x 6' trench along the rows in the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour a half tin of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the much as this may cause stem disease.	Moist soil enhances easier bed preparation. 2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes, level with the ground. If below ground level water accumulates reducing aeration and can cause stem disease. **Direct seeding:** Direct seedling is not suitable for white eggplant.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** If necessary, stake plant with bamboo to prevent lodging. Staking improves fruit quality and yield.	Pour water 1 liter per plant every second day.
2-4 weeks after planting	**Pruning:** Remove side shoots below first or second truss. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem extract solution in every week. If this does not work well, use chemical control measures as a last option (see photos below).	Pour water 2 liters per plant 2 days interval.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06 ac) at a rate of 1 teaspoonful per plant. Also apply 9:25:25 compound fertilizer (6 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) in the trench and cover with soil. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 2 liters per plant 2 days interval.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand. Apply Potassium Nitrate in the morning at a rate of 10 ticals/4 gallon (10 ticals/0.06ac).	Pour water 3 liters per plant every second day.

5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06ac and apply at a rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters per plant every second day.
6 - 9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply Potassium Nitrate in the morning at a rate of 10 ticals/4 gallon (10 ticals/0.06ac).	Pour water 3 liters per plant after fertilization
Pest & Diseases Control	**Chemical and Organic Options:** Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.	

Description	Control measure
• **Shoot borer** (Photo 1)	• Spray neem extract pesticide. Trade name - Prevathon (Chlorantraniliprole) or Alan.
• **White flies** (Photo 2)	• Spray Trade name – Dozar 70 WP
• **Leaf Spot** (Photo 3).	• Spray Trade name – Unity
• **Bacterial Wilt** (Photo 4)	• Remove plant and burn it: rotate crops. Spray Carsumin plus cupper.

1. Shoot borer

2. White flies

3. Leaf Spot

4. Bacterial Wilt

Harvesting	Harvesting can be done about 25-40 days after flowering depending on fruit shape and market.
Quality Tips	Harvest regularly. Over mature fruits are bitter.

Coriander Crop Management Tips		
Variety Selection	Select marketable and high yielding varieties (e.g. Axe brand Thai., Pan brand Thai; and Red Arrow brand East- West Co.)	
Season Preference	Coriander likes the cool and dry season (Nov to Feb) but can grow the whole year. Cloudy weather during flowering and fruiting stage favors pest and disease incidences. Heavy rains affect the crop. In hot summer, life period is short and yield is reduced. Can be grown in the monsoon under cover.	
Crop Duration	For fresh coriander leaf, harvesting can start 30 days after direct seeding till flowering time (about 30-60 days). The crop for seed production will be ready for harvest in about 90 -100 days depending upon the varieties and growing season.	
Estimated Yield	Average yield (fresh coriander leaf) is 8,800 bundles / 0.06 acre	
Seed Rate	3 - 5 packets (500 g / pack)/ 0.06 acre	
Site Selection	As an irrigated crop, it can be cultivated on almost all types of soils provided sufficient organic matter is applied.	
pH	Prefers 6 -7.5	
Irrigation	Furrow irrigation should be used for large areas. Drip or hand watering should be used for small areas. Sprinklers can cause leaf diseases. Coriander cannot tolerate drought, so must not be allowed to dry out. Young plants need less water than older plants. Save water and labor by using drip, or shower rose in between plant rows on the top of beds. Furrow irrigation between beds wastes water and encourages weeds and leaf disease.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land preparation:** Plough 2 times to 6 – 9 inches depth and harrow 2-3 times to get fine tilth.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
	Raise bed preparation: Form channels between beds for irrigated crop. Make raise beds of 3 feet wide, 6 - 9 inches high 1.5 feet wide and as long as necessary. The advantages of making raise beds are (1) good drainage, (2) good soil aeration, (3) easy root penetration, (4) easy irrigation between beds, (5) less evaporation, and (6) increase of organic materials in soil.	Moisten the soil as necessary.

1 week before planting	**Basal fertilizer:** Apply 6 viss of 15:15:15 compound fertilizer / 0.06 acre with bokashi (37 - 74 viss/0.06ac) mixed with soil across the whole of the beds.	
	Row making and plant spacing: On the raised beds, make 3 inches wide shallow 0.5 (half) inch depth trenches in preparation for direct sowing. A rake can be used for row making.	Moist soil enhances easier bed preparation.
	Seed soaking: Seeds stored for 15 – 30 days get better and earlier germination than freshly harvested seeds. Whole seeds do not germinate and hence they are split into two halves before sowing. Seeds that are soaked in water for 24 hours before sowing also enhance better germination. After soaking, put the seeds for one day incubation under a moistened cloth.	Change fresh water 6 hourly.
Planting Techniques	**Direct seeding:** Direct seedling is suitable for coriander. Incubated seeds are put 1 inch apart by hand in the 0.5" deep trenches. Then, seeds are covered with soil and soil depth should not be exceeded 2 x the diameter of the seed.	Watering should be done immediately after sowing the seeds. The second is done on the third day.
1 weeks after planting	**Mulching:** Mulch with rice straw 3" thick on the raised bed to reduce soil temperature, maintain soil moisture, prevent weeds, and protect erosion. Notice not to interfere with germinated sprouts.	Provide water in every 3rd day.
2 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease.	Provide water in every 3rd day.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Pest & disease control:** For prevention, use organic methods like EM 5 and Neem. If this does not work well, use chemical control measures as a last option. (See photos below). Flag leaf emergence- frag leaf emerge 2-3 week after sowing. Excess water in this stage cause damping off disease. So, take care. **Supplementary fertilizer:** Add 1 viss of urea/ 0.06 ac for first top dressing.	Provide water in every 3rd day. Drain off excess water to prevent stem disease.
4 weeks after planting	**Thinning:** no need. **Weeding:** As required, preferably controlled by hand.	Irrigate or pour water in every 2nd day.
5 weeks' after Planting (for fresh consumption)	**Weeding:** As required, preferably controlled by hand. **Foliar fertilizer:** Apply 11:8:6 ratio of foliar spray 30 gm mix with 4 gallons for vegetative growth. (2 tical /0.06 ac) **Pests and disease control:** In the seedling stage, leaf eating caterpillars, semi-loopers and aphids attack plants. Use EM 5 or Neem organic pesticides only. **Harvesting fresh coriander:** Fresh coriander stem with the leaf are harvested together at harvesting time. Cut or pull out the plants and send to the market.	Irrigate or pour water in every 2nd day.
6-8 weeks after planting (for seed purpose)	**Weeding:** As required, preferably controlled by hand. **Foliar fertilizer:** Apply urea solution 1 viss for 0.06 acre. as second top dressing.	Irrigate or pour water in every 2nd day.

	Flowering: Flowering usually starts at about 45 -55 days after sowing. At that stage, the use of any pesticide would kill the bee population affecting the pollination in the crop.	
9 -15 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Harvesting seeds:** Harvesting has to be done when the fruits are fully ripe and changing from green to brown color. Delaying of harvest should be avoided reduce shattering during harvest and splitting of the fruits in subsequent processing operations. The plants are pulled and put into small stacks for drying, then beaten with sticks or rubbing with hands to get the seed from the pods. The seed should then be winnowed, cleaned and dried in the partial shade. After drying, the seed is stored in gunny bags lined with paper.	Irrigate or pour water in as necessary. Stop watering when fruit color changes into yellow.
	Chemical and Organic Options:	
	Description	**Control measure**
Pest & Diseases Control	Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures. • Semi-looper (Photo 1) • Aphids (Photo 2) • Damping off (Photo 3)	• Acetamiprid 1.6 % + Cypermethrin 7.2 % EC • Deltamethrin 2.5% EC Acephate 75 % SP • Benomyl 50 % WP Metalaxyl 2.5 % WP

1. Raise bed

2. Coriander plants

3. Bundle of coriander leaf

4. Coriander seeds

Semi-looper (Photo 1)

Aphids (Photo 2)

Damping off (Photo 3)

Harvesting	Harvesting coriander leaf starts at about 30 days after sowing the seeds and ends at about 55 days after sowing depending on the market. For seed production, coriander takes 90 – 105 days of crop growth before harvesting the seed pods.
Quality Tips	Best quality fresh leaf is produced in cool and dry season. Correct watering and top dressing are important for good quality. Grain mold disease may drop seed quality.

Cabbage Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties. (eg. Paride - 004)	
Season preference	Cabbages can be grown in both dry and wet seasons but too much rain may cause rots and heads to split. However, cabbages prefer the cold season to get firm heads.	
Crop Duration	65-90 days first harvest after transplanting.	
Yield Expectation	Average yield 580 head/0.06 acre	
Seed requirement	1 pack (10 gm / packet), 580 plants per 0.06 acre	
Site selection	Cabbages will tolerate a wide range of soil types.	
pH	Prefers 5.5-6.8	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Plants should not be allowed to dry out. Irregular watering during head development can cause heads to split. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep ploughing (6-8 inches) and 2-3 harrowings should be done. **Liming:** Apply 13 viss of lime per 0.06 ac per year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
3 weeks before planting	**Nursery Preparation:** Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 15-25 days old.	Watering is necessary every morning for moist soil for seedlings as necessary
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 1.5 feet apart. The advantage of raised beds are as follows: (1) good drainage, (2) good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil.	Moist soil enhances easier bed preparation.
	Row making and plant spacing: Plant seedlings in rows 1.5 feet apart and 2 feet spacing between the plants in a zig-zag pattern. Should leave 6'' at the end of the beds.	Moist soil enhances easier bed preparation.

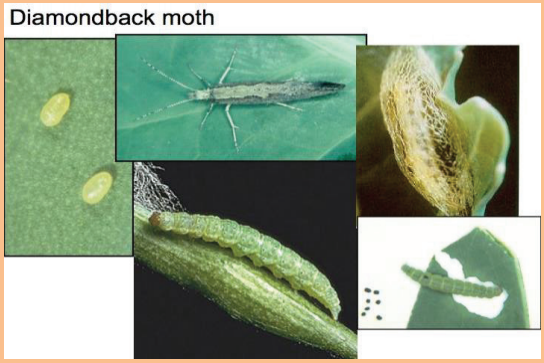
1 week before planting	**Basal fertilizer:** Apply 6 viss 15:15:15 compound fertilizer per 0.06 ac, mixed with the Bokashi compost at 37-74 viss per 0.06 ac in a 10" x 6" trench along the rows and cover with soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 150 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the much as this may cause disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Direct seedling is not suitable for cabbage.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Infilling is required to leave 1 strong plant per hole.	Pour water 1 liter per plant every second day.
2 -3 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Note -** Cabbages have shallow roots so do not deep hoe to remove weeds. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06 ac and apply at a rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem in every week. If this does not work well, use chemical control measures as a last option (see photos below).	Watering should be applied sparingly to give a full tight head. Too much water can crack the heads.
4-5 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06 ac and apply at a rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters per plant every second day.
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply Potassium Nitrate (KNO3) in the morning at a rate of 10 ticals per 4 gallons of water (10 ticals per 0.06ac). Also apply urea in the morning at the rate of 1 teaspoonful per plant (5 viss/0.06ac)	Pour water when the soil is dried after fertilization

Pest & Diseases Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Diamond back moth (Photo 1) • Grey Mildew. (Photo 2)	• Spray with EM-5 solution every week from transplant stage. If caterpillar found, spray neem insecticide or Abamectin and Imidacloprid. Remove caterpillars by hand.
• Alternaria Leaf Spot. (Photo 3) • Soft Rot. (Photo 4)	• Apply Unity or Mancozeb. • Apply Bordeaux mixture or Mancozeb. • Remove infected plant or plant portion immediately. Can apply Kasugamycin, Bordeaux mixture to control bacterial diseases.



Diamond Back Moth

Grey Mildew

Alternaria Leaf Spot

Soft Rot

Harvesting	Harvest when head is firm. Outer 3 leaves can be left on to protect the head from damage during transport.
Quality Tips	Uneven watering will cause the heads to split. It is very important to control insects to prevent damage of leaves and head.

Cauliflower Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties. Use a hybrid that is resistant to soft rot disease. (eg. Poornimi 008, Silver cap)	
Season preference	Cauliflower can be grown the best in late rainy and cool season. The weather is more important than soil condition for cauliflower. It needs the cool conditions to get firm heads.	
Crop Duration	65-90 days to harvest after transplanting.	
Yield Expectation	Average yield 580 heads/0.06 acre	
Seed requirement	1 pack (10g / pkt), 726 plants per 0.06 acre	
Site selection	Cauliflower will tolerate a wide range of soil types.	
pH	Prefers 6 - 6.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Water all of the plants evenly and regularly, especially early to prevent buttoning. Quality will be reduced if plants go dry at any time. **Fertigation:** Can be used when using drip.	

Time for Operation	General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)	Watering
1 month before planting	**Land Preparation:** Plough to 6-8 inches depth and 2-3 harrowings should be done. **Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
3 weeks before planting	**Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5** should be prepared 3 weeks before planting to allow good decomposition (guidelines in appendix)	Keep Bokashi moist
	Nursery Preparation: Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at the ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 15-25 days old.	Watering is done every morning for moist soil for seedlings as necessary
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide with beds 1.5 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between row furrow irrigation, less evaporation and a greater amount of organic material in the soil.	Keep Bokashi moist.

	Row making and plant spacing: Plant seedlings in rows 2 feet apart and 1.5 feet spacing between the plants in a zig-zag pattern. Should leave 6" at the end of the beds.	Moist soil enhances easier bed preparation.
1 week before planting	**Basal fertilizer:** Apply 6 viss /0.06 ac of 15:15:15 compound fertilizer and the bokashi compost at about 37-74 viss/0.06 ac in a 10" x 6" trench. Then mix into the soil. Pour 150 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as this may cause stem disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Direct seedling is not suitable for Cauliflower.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Infilling is required to leave 1 strong plant per hole. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) at 2 viss/0.06ac and apply at the rate of 1 teaspoonful per plant.	Pour water 1 liter per plant every second day.
2 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Note -** Cauliflower have shallow roots so do not deep hoe to remove weeds. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem extract solution in every week. If this does not work well, use chemical control measures as a last option (see photos below).	Watering should be done sparingly to maintain a full tight head. Under moist conditions, the heads can crack.
3 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Note -** Cauliflower have shallow roots so do not deep hoe to remove weeds. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply urea in the morning at a rate of 1 teaspoonful per plant (4 viss per 0.06ac)	Pour water 2 liters per plant every second day.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant **1'** away from the base of the plant because the roots are spread wider than before. **Plant caring:** Fold or tie leaves of the head when it is about the size of an egg to keep it white. (see photos below).	Pour water 2 liters per plant every second day.

<table>
<tr><td></td><td>  </td><td></td></tr>
<tr><td>5 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.</td><td>Pour water 2 liters per plant every second day after fertilization.</td></tr>
<tr><td>6-8 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.</td><td>Pour water 3.5 liters per plant every second day.</td></tr>
<tr><td>9-10 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.</td><td>Pour water 4 liters per plant every second day</td></tr>
<tr><td>Pest & Diseases Control</td><td colspan="2">Chemical and Organic Options:
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• Grey Mildew. (Photo 2)

• Alternaria Leaf Spot. (Photo 3)

• Soft Rot. (Photo 3)</td><td>• Spray with EM-5 solution every week from transplant stage. If caterpillar found, spray neem insecticide or Abamectin and Imidacloprid. Remove caterpillars by hand.

• Apply Bordeaux mixture or Mancozeb.

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• Remove infected plant or plant portion immediately. Can apply copper base bactericide to control bacterial diseases.</td></tr>
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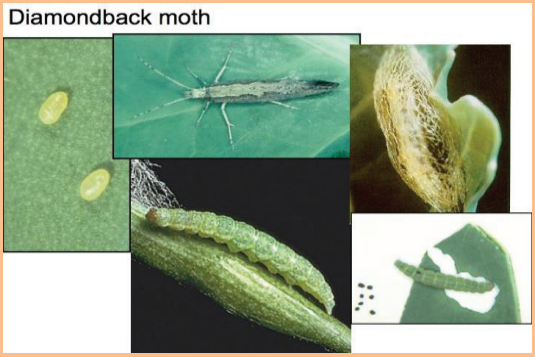


Diamond Back Moth

Grey Mildew

Alternaria Leaf Spot

Soft Rot

Harvesting	Harvest when head is firm. Leaving about 4” – 6” of stem. Outer three leaves can be left to protect the head from damage during transport. Cauliflower is harvested while the heads are pure white and not splitting.
Quality Tips	Fold or tie leaves of the head when it is about the size of an egg to keep it white. Cauliflower is more heat tolerant than cabbage.

Broccoli Crop Management Tips		
Crop Variety Selection	Use shorter duration, heat tolerant varieties (eg. Seed energy, Tokita, Harumi F1).	
Season preference	Broccoli can grow best in the cool season.	
Crop Duration	75-90 days to harvest.	
Yield Expectation	Average yield 580 head/ 0.06 acre	
Seed requirement	1 pack (10g / pkt), 726 plants per 0.06 acre	
Site selection	Although broccoli will tolerate a wide range of soil types, sandy loam is the best.	
pH	Prefers 6 - 6.5	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Water all of the plants regularly, especially early to prevent buttoning (small heads). Quality will be reduced if plants go dry at any time. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Plough 6-8 inches deep and 2-3 harrowings should be done. **Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepare 3 weeks before planting to allow good decomposition **.** (guidelines in appendix)	Keep Bokashi moist
3 weeks before planting	**Nursery Preparation:** Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at the ratio of 1:1:1) in to the tray. (guidelines in appendix). Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 15-25 days old.	Water every morning for moist soil for seedlings as necessary
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 1.5 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and greater organic material in soil.	More water as necessary.
	Row making and plant spacing: Plant seedlings in rows 2 feet apart and 1.5 feet spacing between the plants in a zig-zag pattern. At the end of the beds, 6" should be left.'	Moist soil enhances easier bed preparation.

1 week before planting	**Basal fertilizer:** Apply 6 viss of 15:15:15 compound fertilizer for 0.06 ac, Bokashi compost about 37-74 viss per 0.06 ac in a 10" x 6" trench along the rows and mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 150 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as is may cause disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Direct seedling is not suitable for broccoli.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Infilling is required to leave 1 strong plant per hole. Apply Epsom salt (Magnesium sulphate-$MgSO_4$) 2 viss/ 0.06ac and apply at the rate of 1 teaspoonful per plant.	Pour water 1 liter per plant every second day.
2 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Note -** Broccoli have shallow roots so do not deep hoe to remove weeds. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem extract solution in every week. If this does not work well, use chemical control measures as a last option (see photos below).	Watering should be sparingly to produce full tight heads. Overwatering can cause the heads to crack.
3 weeks after planting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Note -** Broccoli have shallow roots so do not deep hoe to remove weeds. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3"** from the base of the plant along the whole bed row. Apply urea in the morning at the rate of at the rate of 1 teaspoonful per plant (4 viss/0.06ac)	Pour water 2 liters per plant every second day.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply 3.5 viss of 9:25:25 compound fertilizer for 0.06 ac with 1 tablespoonful (about 10 g) per plant 1' away from the base of the plant **Plant caring:** Fold or tie leaves of the head when it is about the size of an egg. (see photos below). 	Pour water 2 liters per plant every second day.

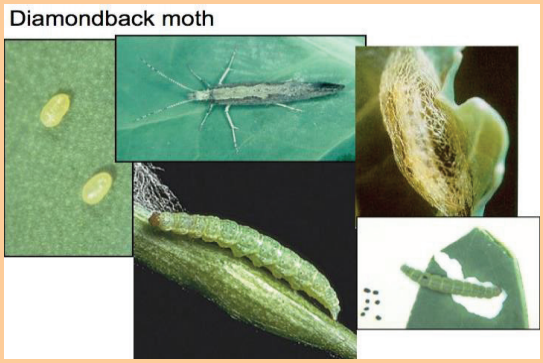
5 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Pour water 2 liters per plant every third day. after fertilization.
6-8 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Pour water 3.5 liters per plant every third day.
9-10 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Pour water 4 liters per plant every third day.

Pest & Diseases Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Diamond back moth (photo 1)	• Spray with EM-5 solution every week from transplant stage. If caterpillar found, spray neem insecticide or Abamectin and Imidacloprid. Remove caterpillars by hand.
• Grey Mildew. (photo 2)	• Apply Bordeaux mixture or Mancozeb.
• Alternaria Leaf Spot. (photo 3)	• Apply Bordeaux mixture or Mancozeb.
• Soft Rot. (photo 3)	• Remove infected plant or plant portion immediately. Can apply copper base bactericide to control bacterial diseases.



Diamond Back Moth

Grey Mildew

Alternaria Leaf Spot

Soft Rot

Harvesting	Harvest when head is firm. Leave about 4” - 6” of stem. Outer three leaves can be left on to protect the head from damage during transport. Broccoli is harvested just before the heads change to a yellow color.
Quality Tips	Fold or tie leaves of the heads when it is about the size of an egg.

Sweet Corn Crop Management Tips		
Crop Variety Selection	Hybrid corn seeds provide high yields but requires a large amount of fertilizers and water. Varieties currently used are Pan-Gold, Pan-75, Pan-color 5 and Pan-White. Local varieties will get lower yield but are resistant to pests & diseases, and are more tolerant to weather changes.	
Season preference	Sweet corn should be grown at post monsoon season (Last week of September to first week of December planting). Seed germination and good vegetative growth are likely when there is enough soil moisture.	
Crop Duration	Depending on the variety and climate, ears may be harvested 70 – 90 days after seeding.	
Yield Expectation	Average harvested yield is 1,450 ears per 0.06 acre.	
Seed	Amount of Seeds required per 0.06 acre will be 1 packet (500g)	
Site Selection	Sweet corn thrives well in a wide variety of soils, but does not like water logging and performs best in sandy loam soil.	
pH	Prefers 6 -7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds wastes water and encourages weeds and leaf diseases. Corn is relatively tolerant of water shortage during the vegetative stage and during ripening of the cob. Water deficit during the flowering period causes a reduction in yield because the female flowers dry out and do not pollinate properly and the male flowers release their pollen too early to pollinate the female flowers. **Fertigation:** Can be used when using drip.	

Time for Operation	General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)	Watering
1 month before planting	**Land Preparation:** Deep ploughing to 9 - 12 inches and 2-3 times of harrowings should be done.	
3 weeks before planting	**Liming:** Add 13 viss of lime per 0.06 acre per year for three consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist

2 weeks before planting	**Raised Bed Preparation:** Make raised beds 9 -12 inches high, 3 feet wide and 1.5 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and greater organic material in soil. **Row making and plant spacing:** On the beds, mark 2 rows 2 feet apart and 6" from the edge of the bed. Plants should be 9 inches apart along the rows.	At the seeding time, it is important to retain the soil moisture.
1 week before planting	**Basal fertilizer:** Mix 6 viss /0.06 ac of 15:15:15 compound fertilizer, 37-74 viss/0.06 ac of Bokashi compost, and put in 10" x 6" trench along the rows and then mix in the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour a half tin of Trichoderma solution (7g / 10 liters) into each hole 2 days before transplanting.	2 days before seeding, require the soil with enough soil moisture
Planting Techniques	**Direct seeding:** Depth of planting seeds should be 2 times their diameter. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as this may cause stem disease.	At the seeding time, it is important to retain the soil moisture.
1 week after planting	**Thinning or infilling :** Thinning or infilling is required to leave 1 strong plant per hole.	Pour water 1 liter per plant every second day.
3 weeks after planting	**Weeding:** Clean weeds when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM-5 and Neem. If this does not work well, use chemical control measures as a last option. (see photos below) **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply 6 viss of compound fertilizer 9:25:25 and 6 viss of Urea for 0.06 ac and apply at the rate of 1 table spoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 2 liters per plant every second day. Or
11 weeks after planting	Start harvesting ears.	

Female flowers (silk)

Male flowers (Tassels)

Row planting

Pests and Diseases control

Inspect the pest and disease symptoms regularly. It is required to observe thoroughly on both sides of upper and lower leaf surfaces.

Description	Control measure
• Grey coloured spindle shape blotches (Photo No. 1) • Stem rot dieing off from top to bottom (Photo No. 2) • Worms on the ear (Photo No. 3).	• Remove infected plant parts. Use crop rotation. Spray Chlothalonil. • Remove infected plant debris. Use crop rotation. • Spray Abamitin or Chlotwaniliprol.

1. Leaf blight

2. Stem rot

3. Caterpillars on the seeds

Harvesting	Ears can be harvested at about 3 weeks after pollination (or) when silk colour changes into brown and dry.
Quality guidelines	Adequate soil moisture at silking time is essential for getting fully filled seeds.

Radish Crop Management Tips		
Crop Variety Selection	Select varieties are marketable, high yielding, and are resist to pest and disease. (Eg. Ural 219 EW)	
Season Preference	Radish can grow well in winter season (Sept-Nov planting).	
Crop Duration	Early variety 21-25 days after sowing. Long variety 30-45 after sowing.	
Yield Expectation	4,400 roots per 0.06 acre	
Seed requirement	2 tins (100/tin). 4,400 plants /0.06 acre	
Site selection	Radish prefer sandy loam.	
pH	Prefers 6 - 7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. Irrigation: (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to 9" - 12" and 2-3 harrowings should be done. **Liming**: Lime 13 viss/0.06 ac. 3 years consecutively.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepare 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
1 week before planting	**Raised Bed Preparation:** Build raised beds 12 inches high, 3 feet wide and 1.5 feet apart. Advantages of Raised bed- 1) Good drainage, 2) Good ventilation for the soil, 3) Easy for root to penetrate the soil, 4) furrow irrigation, 5) greater than soil moisture, and greater than organic material in soil. **Basel:** In a 10" x 6" trench along the rows, mix in 12 viss compound 15:15:15 fertilizer and 37-74 viss/0.06 acre of Bokashi. Use well composed manure (if not well decomposed the	Moisture may be help for land preparation. Keep moisture 2 days before sowing.

	manure may cause small root hairs so may reduce market quality). **Row and Plant Spacing:** Space rows 8 inches apart & plant spacing 2-3 inches between plants depending on the size of the radish you want. Spread Trichoderma solution (7g/10 liter) evenly over the raised beds 2 days before sowing. **Nursery:** No need to make nursery. **Digging the hole:** No need to dig holes**.**	
Planting Techniques	**Transplanting:** Radishes should be direct seeded. Transplanting makes the plants weak and can cause lateral roots. **Direct seeding:** Depth of planting seeds should be 2 times the seed diameter. Sprinkle the seeds evenly along the row. Lightly cover with soil. **Mulching**: To prevent weeds, reduce soil temperature, to prevent soil disease spreading to the fruit and prevent erosion mulch the beds with straw or plastic mulch.	In the evening, water the raised beds before sowing. Don't water immediately after sowing because shallow planted seeds may be washed away with the water.
1 week after planting	**Thinning of infilling:** Thinning or infilling is required to leave 1 strong plant per 2-3 inch spacing. **Trellising: No need to trellis.** **Pruning: No need to prune.** **Weeding**: Remove weeds to prevent nutrient competition and host for pests and diseases. **Pest and Disease Control:** Spray EM 5 or Neem extract pesticide at 1 week intervals regularly and EM 5 as a repellent every three days. As the last option, use chemical.	Watering 8 liters per meter at 1 day intervals.
2 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Foliar spray:** Apply urea in the morning at the rate of at the rate of 1 teaspoonful per plant (0.5 viss/0.06ac).	Watering 8 liters per meter at 1 day intervals.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Foliar spray:** Apply Epsom salt (Magnesium sulphate-$MgSO_4$) 2 viss/0.06ac at the rate of 1 teaspoon/Liter and apply over the whole raised bed.	Watering 12 liters per meter at 1 day intervals.
4 weeks after planting	**Weeding:** As required, preferably controlled by hand.	Watering 14 liters per meter at 1 day interval.
5-7 Weeks after planting	**Weeding:** As required, preferably controlled by hand.	Watering 16 liters per meter at 1 day interval.
Pest & Diseases Control	**Chemical & Organic Options:** Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.	

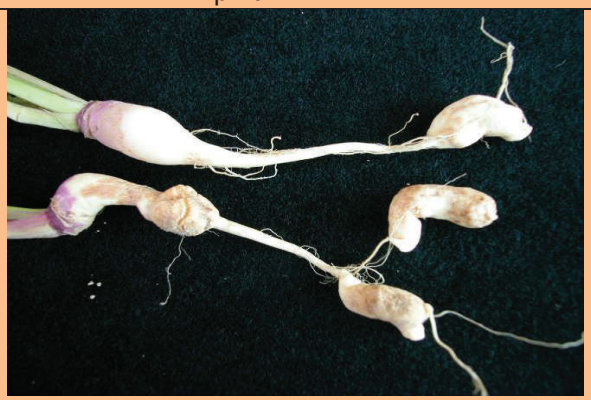
Description	Control measure
• Leaf miner (Photo 1)	• Spray Neem extract insecticide or Abamectin Demon

	• Aphid (Photo 2) • Army worm (Photo 3) • Club root (Photo 4)	• Spray Neem extract insecticide or rotate crop • Spray Alarm • Add liming or rotate crop	

1. Leaf Miner

2. Aphid

3. Army worm



4. Club Root

Harvesting	Radish should be pulled when marketable size and cleaned with water.
Quality Tips	Maintain soil moisture and plant nutrients. Don't water for 2 weeks before harvest to get delicious roots. Take care not to damage the root in the storage period.

Water cress Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties like Thaiwan leafy variety Liao 9.	
Season preference	Water cress can be grown the whole year but prefers the warmer season.	
Crop Duration	First harvesting at 25 - 30 days after seeding. Can harvest throughout the year with good management.	
Yield Expectation	Average 8,800 bunches per 0.06 ac	
Seed requirement	1 pack (1 kg / pack), 4,400 plants per 0.06 acre	
Site selection	Water cress will tolerate a wide range of soil types but needs to be well drained.	
pH	Prefers 5.5-7	
Irrigation	Furrow irrigation should be used for large areas. Drip or hand watering should be used for small areas. Sprinkler is most suitable for water cress. Young plant needs less water than older plants. Save water and labor by using drip, or flood with shower rose in furrow in between plants rows on top of the beds. Consistent even moisture is needed throughout the season. This leaf crop is shallow rooted and needs frequent irrigation.  Water cress plant by using sprinkler irrigation **Fertigation:** Can be used when using drip (guidelines in appendix X)	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Land Preparation:** Deep ploughing at 9 - 12 inches and 2-3 harrowings should be done.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	

<table>
<tr><td>1 week before planting</td><td>Raised Bed Preparation: Dig raised beds 6-8 inches high, 3 feet wide and 1.5 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and more organic material in soil.
Row making and plant spacing: Plant seedlings in rows 8 inches apart and 6 inches spacing between the plants.
Basal fertilizer: Mix in the topsoil 6 viss of 15:15:15 compound fertilizer for 0.06 ac, the Bokashi compost about 37-74 viss per</td><td>2 days before planting, moisten the soil as necessary</td></tr>
<tr><td></td><td>0.06 ac over the whole bed. Pour 150 ml of Trichoderma solution (7g /10 liters of water) over the whole bed.</td><td></td></tr>
<tr><td>Planting Techniques</td><td>Transplanting: There is no requirement for transplanting.
Direct seeding: Plant 5 seeds/hole. The seed should be planted twice the diameter into the soil. The seed will emerge 2-3 days after seeding.
Mulching: Mulch with rice straw 3” thick or rice husk on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion.</td><td>Lightly water immediately after transplanting</td></tr>
<tr><td>2 weeks after planting</td><td>Weeding: Weed when required to stop weeds taking nutrients and providing a home for pest and disease.
Pest & Disease control: For prevention, use organic methods like EM5 and Neem extract solution in every week. If this does not work well, use chemical control measures as a last option (see photos below).
Foliar spray:
Apply 2 viss of urea for 0.06 ac at the rate of 1 teaspoonful per 1 liter of water and spray thoroughly on the whole raised beds.</td><td>Pour water every 2 days interval.</td></tr>
<tr><td>5 weeks after planting</td><td>Weeding: Weed when required to stop weeds taking nutrients and providing a home for pest and disease.
Foliar spray:
Apply urea (2 viss/0.06 ac) at the rate of 1 teaspoonful per 1 liter of water and spray thoroughly on the whole raised bed.</td><td>Pour water every 2 days interval.</td></tr>
<tr><td>Pest & Diseases Control</td><td colspan="2">Chemical and Organic Options:
Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

<table>
<tr><th>Description</th><th>Control measure</th></tr>
<tr><td>1. Leave miner (Photo 1)

2. Spider mite (Photo 2)

3. Rust (Photo 3)</td><td>1. Remove by hand, Apply neem extract solution, EM -5, Abatamitin.
2. Apply ash, neem extract solution, sulphur.

3. Apply Mencozeb, Cymoxanil (synergy) and Unity.</td></tr>
</table>
</td></tr>
</table>

1. Leave miner

2. Spider mite

3. Rust

Harvesting	Harvesting can be done about 3 weeks after seeding. Water thoroughly the day before and the day of harvest. It can be cut about 1" above the ground. Can be harvest the new shoots for about 7-10 days after previous harvest or depending on market requirements.
Quality Tips	Critical to check plant water requirement in water cress. Pest and diseases management is also required so as not to damage the leaves.

Mustard Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties (White mustard for cooking and green mustard for pickling)	
Season preference	Oct to Jan is most suitable for Rakhine state. Mustard prefers to grow from Feb, March, Apr & May. Although it can grow during raining season, it can't resist flooding.	
Crop Duration	Leaves can be harvested 25-30 days after planting. For seed production will be ready for harvest at 75% fruit maturity.	
Yield Expectation	Yield will depend on the plant spacing. About 6,600 plants per 0.06 acre can be harvested.	
Seed	5 gm 3 packets	
Site selection	Although it can grow in all soil types, fertile soil is preferable. Need to avoid flooded area.	
pH	Prefers 5.3 - 6.5	
Irrigation	Moisture is required thought the growing season. In the dry season, hay or straw can be used to keep moisture at the base of the plants. Irrigate when required but need to be careful not to flood. Sprinkler is most suitable for mustard.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough 9 -12 inches and 2-3 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years. **Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5** should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix) **Nursery Preparation:** Use a 105 holes nursery tray. Add soil media (a mixture of garden soil, well decomposed cow manure, and burned rice husk at the ratio of 1:1:1) into the tray. Plant 1 seed / hole. It takes 5-6 days to germinate and the plants are ready for transplanting into the field when they are 21 days with about 4-5 leaves.	Keep Bokashi moist Water every morning to moist soil for seedlings as necessary
1 Week before planting	**Raised Bed Preparation:** Make raised beds 9 -12 inches high, 3 feet wide and 1.5 feet apart. The advantage of raise beds are as follows; (1) Good drainage, (2) Good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil. **Row making and plant spacing:** Rows should be 6 inches apart and plants 6 inches spacing in the rows in a zig-zag layout. 6 inches must be left at the edge of the bed. **Basal fertilizer:** Mix 6 viss/0.06 ac of 15:15:15 compound fertilizer, with 37-74 viss/0.06 ac of Bokashi compost, and incorporate in the soil across the whole bed. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the much as it may cause plant disease.	Moist soil enhances easier bed preparation.

Planting Techniques	**Transplanting:** Carefully (without breaking the roots ball) transplant 1 healthy seedling into seedling holes. **Direct seeding:** Direct seedling can also be practiced. Use high dose of seed for direct seeding and thinning should be done when 2-3 leaves plants leaving 2-3 inches spacing. Thinning should be carried out whenever the plants crowded. If the plants become well grown the thinning plants can also be used for cooking or selling.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. Thinning should be done to the final spacing of 6 inches. **Pruning/Suckering:** Remove side shoots (suckers) below the first or second truss. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem. If this does not work well, use chemical control measures as a last option	Pour water in every second day but not too much as this plant does not tolerate flooding.
2 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** The plants are growing fast and when 25-30 days after planting, it can be harvested and thus no special side dressing is needed. But for seed production, side dressing is needed. Apply Epsom Salt (Magnesium sulphate-$MgSO_4$) at 2 viss / 0.06 ac 15:15:15 compound fertilizer (6 viss/ 0.06 ac) at the base of the plants but apart 3 inches from the plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water in every second day but not too much as this plant does not tolerate flooding.
3 weeks after planting	**Weeding:** As required, preferably controlled by hand. Foliar **fertilizer:** Spray Potassium Nitrate (KNO_3) solution 10 ticals mixed with 4 gallons of water and spray in the morning (10 ticals/0.06ac) thoroughly starting from flowering.	Pour water in every second day.
4 Weeks after planting	**Weeding:** As required, preferably controlled by hand.	Pour water every second day.
5 Weeks after Planting	**Weeding:** As required, preferably controlled by hand. Foliar **fertilizer:** Apply Potassium Nitrate (KNO_3) solution 10 ticals mixed with 4 gallons of water and spray in the morning (10 ticals/0.06ac).	Pour water every second day.
6-9 weeks after planting	**Weeding:** As required **Pest & Disease control:** As required	Pour water every second day.

Pest & Disease Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at bot leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
Pests • Crucifer flea beetle (Photo 1) • Dingy cutwrom (Photo 2) • Redback cutworm (Photo 3) • Diamondback moth (Photo 4) • Grasshopper (Photo 5)	• spray EM5 or Neem spray. If not effected used Imidacloprid
Diseases • Powdery mildew (Photo 6) • Downy mildew (Photo 7) • Damping off (Photo 8) Aster Yellows Phytoplasma (Photo 9)	• Crop rotation (non *Crucifereae* plant) and remove plant and burn it. • Apply fungicide as Mancozeb Copper Hydroxide + Kasugamycin spray

Pest & Diseases Control

1. Crucifer flea beetle

2 Dingy cutworm

4. (a) Diamond back moth pupa

3. Redback cutworm

4. (b) Diamondback moth larvae

5. Grasshopper

6. Powdery mildew

7. Downy mildew

<table>
<tr><td> 
8. Damping off</td><td colspan="2"> 
9. Aster Yellows Phytoplasma</td></tr>
<tr><td>Harvesting</td><td colspan="2">The plant can be uprooted if the plant density is high. Or the outmost leaves can be harvested one by one. If the plants are grown for seed production the flower stalk will emerge only after 70-80 days after planting. When 75% of fruits are matured, it is time to harvest the seed.</td></tr>
<tr><td>Quality Tips</td><td colspan="2">To harvest good quality mustard, you must manage properly water application, soil fertility and control pests and diseases.</td></tr>
</table>

Bottle Gourd Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties (eg. Local long variety, Anmol F1, Lina 237).	
Season preferet	Gourds can growth whole year, however, in the rainy season they will get more leaf diseases. Gourd will grow best in the dry season.	
Crop Duration	Start harvest 45-50 days after transplanting. Crop duration is 90 -120 days.	
Yield Expectation	Average yield 680 fruits per 0.06 acre	
Seed	20 g (2packets), 136 plants per 0.06 acre	
Site selection	Bottle gourds like light well drained soils with high organic matter	
pH	Prefers 6-7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinklers may cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. **Fertigation:** Can be used when using drip	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough 9 - 12 inches and 2-3 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepare 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 9 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between bed furrow irrigation, less evaporation and greater organic material in soil.	Keep Bokashi moist.
	Row making and plant spacing: In the internal beds, have 2 rows, 2 feet apart. In the outside beds only 1 row in the center of the bed. At the end of the beds should leave 6''.	Moist soil enhances easier bed preparation.
	Nursery Preparation: Use a 60 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung, and burned rice husk a ratio of 1:1:1) in the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 21 days about 4 inches high or have 4-5 leaves.	Water every morning for moist soil for seedlings as necessary

1 week before planting	**Basal fertilizer:** Apply 6 viss/0.06 ac of 15:15:15 compound fertilizer, the bokashi compost about 3.5 viss/ 50 feet long bed (37-74 viss/0.06 ac) and mix in soil in a 10" x 6" trench along the row.. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour a half tin of Trichoderma solution (7g / 10 liters) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch to prevent disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Plant twice the size of seed depth	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling :** Thinning or infilling is required to leave 1 healthy plant per hole **Trellising:** Farmers should erect a trellis 6 feet high made from bamboo or trellis net. (see photo below).	Pour water 1 liter per plant every second day.
2-4 weeks after planting	**Pruning:** Remove side shoots below 3 feet high. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem in every week. If this does not work well, use chemical control measures as a last option (see photos below)	Pour water 2 liters per plant every second day.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom (Magnesium sulphate-$MgSO_4$) at 60 ticals/0.06 ac at the rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters per plant every second day.
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a small 2" x 2" trench 1' away from the base of the plant because the roots are spread wider than before.	Pour water 3 liters per plant after fertilization

Pest & Diseases Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, please use chemical control measures.

Description	Control measure
• Fruit Fly (Photo 1) • Aphids (Photo 2) • Red pumpkin beetle (Photo 3) • Yellow spots (Photo 4). • White powdery (Photo 5)	• Rotate crop: Use Fruit fly trap (Methyl eugenol) • Organic oil and soap spray. Imidachloroprid or Doza application. • Remove egg clusters by hand or spray Chlorantraniliprole or imidacloroprid • Spray mancozeb 10 days interval and Unity 10 days interval
	• Apply Sulphur dust 25lb/acre

1. Fruit Fly

2. Aphid

3. Red Pumpkin Beetle

3. Downy Mildew

4. Powdery Mildew

Harvesting	Start harvesting 45-50 days after planting. It is important to harvest gourd regularly within 4-5 days interval. Leaving fruit on the vine will slow down growth of the vine and following fruit.
Quality Tips	Maintain soil moisture and plant nutrients. Trellising prevents blemishes and rots. Take care to prevent damage during storage.

Snake Gourd Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties (locally adapted varieties or hybrid such as Polo F1, 855 F1).	
Season preference	Gourds can be grown the whole season, however, in the rainy season they will get more leaf diseases.	
Crop Duration	Start harvest 45-60 days after transplanting. The crop duration is 75-120 days.	
Yield Expectation	Average yield about 1,530 fruits per 0.06 acre	
Seed	20 g (2packets), 102 plants per 0.06 acre	
Site selection	Snake gourds like light well drained soils with high organic matter	
pH	Prefers 6 -7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to 9 -12 inches and 2-3 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix) 	Keep Bokashi moist

2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 9 feet apart.	Keep Bokashi moist. Moist soil enhances easier bed preparation.
	Advantages of raised bed are drainage, aeration, easy root penetration, between row furrow irrigation, less evaporation and a greater amount of organic material in the soil. **Row making and plant spacing:** In internal beds, have 2 rows, 2 feet apart and 6" to the outside of the bed. In the outside bed only 1 row in the center of the bed. Plant should be 3 feet apart along the rows. At the end of the beds, should leave 6''.	
	Nursery Preparation: Use a 105 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) into the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 21 days old at about 4 inches high, or have 4 -5 leaves.	Water every morning for moist soil for seedlings as necessary.
1 week before planting	**Basal fertilizer:** Apply 6 viss of 15:15:15 compound fertilizer/0.06ac and the bokashi compost about 3.5 viss/ 50 feet long bed (37 viss/0.06 ac) into a 10" x 6" trench along the rows and then mix into the soil. **Digging holes:** Dig plant holes about 6" in diameter and 6" in depth. Put one hand full of Bokashi. Pour 40 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6 " thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch as this may cause disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary.
Planting Techniques	**Seedlings:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. Plants should be level with the ground. Not below ground level where water fills the hole causing plant disease and less aeration. **Direct seeding:** Depth of planting seeds should be 2 times the seed diameter.	Lightly water plants immediately after transplanting.
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** Erect a trellis 6 feet high made from bamboo or trellis net. (see photo below).  Snake gourd trellising	Pour water 1 liter per plant every second day.

2-4 weeks after planting	**Pruning:** Remove side shoots below 3 feet of height. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem in every week. If this does not work well,	Pour water 2 liters per plant at 2 days interval.
	use chemical control measures as a last option (see photos below)	
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6** inches from the base of the plant along the whole bed row. Apply 30 ticals of Epsom Salt (Magnesium sulphate-$MgSO_4$) for 0.06ac and apply at a rate of 1 teaspoonful per plant. For plastic mulch, make a hole equally between plants to insert the supplementary fertilizer.	Pour water 3 liters / plant every 2 days.
6-9 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" x 2" trench **1'** away from the base of the plant because the roots are spread wider than before.	Pour water 3 liters/ plant every 2 days, especially after applying fertilizer.
9 weeks to Harvesting	**Weeding:** As required **Pest & Disease control:** As required	Watering depend on the Soil and weather condition

Pest & Diseases Control

Chemical & Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Aphids (Photo 1) • Red pumpkin beetle (Photo 2) • Yellow spots (Downy Mildew) (Photo 3). • White powdery (Photo 4)	• Organic oil and soap spray. Imidachloroprid or Doza application. • Remove egg clusters by hand or spray Chlorantraniliprole or Acetamiprid or imidacloroprid or Fury • Spray mancozeb or Unity 10 days interval • Apply Unity or Sulphur dust 25lb/acre

1. Aphids

2. Red Pumpkin Beetle

3. Downy Mildew

4. Powdery Mildew

Harvesting	Start harvesting at 45-50 days after transplanting. Pick up the gourd fruits at 4-5 days interval regularly. Leaving fruit on the vine will be slow down the plant growth and reduce the crop yield. Harvest in cool temperatures and store in the shade.
Quality Tips	Maintain soil moisture and plant nutrients. Trellising prevents blemishes and rots. Take care to prevent damage during storage.

Ridge Gourd Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding locally adapted varieties or hybrids such as Naga F1) .	
Season preference	Gourds can be grown the whole year, however, in the rainy season they are likely to suffer more leaf diseases.	
Crop Duration	Start harvest 45-50 days after transplanting. Crop Duration is 75-90 days.	
Yield Expectation	Average yield about 1,080 fruits per 0.06 acre	
Seed requirement	20 g (2 packets), 136 plants per 0.06 acre	
Site selection	Ridge gourds like light well drained soils with high organic matter	
pH	Prefers 6 - 7	
Irrigation	Furrow irrigation should be used for large areas. Drip or hand watering should be used for small areas. Sprinklers can cause leaf diseases. Young Plants need less water than older plants. Save water and labor by using drip, or shower rose in between plant rows on the top of beds. Furrow irrigation between beds wastes water and encourages weeds and leaf disease.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to 9 -12 inches and 2-3 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years. **Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5** should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist.
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 9 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between row furrow irrigation, less evaporation and a greater amount of organic material in the soil.	Keep Bokashi moist.
	Row making and plant spacing: In the internal beds, have 2 rows, 2 feet apart. In the outside bed only 1 row in the center of the bed. Space plants at 3 feet apart along rows. 6 inches apart from side, top & end of the bed.	Moist soil enhances easier bed preparation.
	Nursery Preparation Use a 60 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and biochar at a ratio of 1:1:1) into the tray.(guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 4 inches high or have 4-5 leaves.	Water every morning for moist soil for seedlings as necessary

1 week before planting	**Basal fertilizer:** Apply 6 viss /0.06 ac of 15:15:15 compound fertilizer and the bokashi compost about 3.5 viss/ 50 feet long bed (37 to 74 viss/0.06 ac) into a 10" x 6" trench along rows and mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth at the required plant spacing. Pour a half tin of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the much as this may cause plant disease.	2 days before transplanting, moisten the soil for easy digging and water to young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedlings into each of the seedling holes. **Direct seeding:** Can be direct seeded at a depth of 2 times the seed diameter.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** Farmers should erect a trellis 6 feet high made from bamboo or trellis net.	Pour water 1 liter per plant every second day.
2-4 weeks after planting	**Pruning:** Remove side shoots below 3 feet high. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem. If this does not work well, use chemical control measures as a last option (see photos below)	Pour water 2 liters per plant 2 days interval.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom Salt 30 ticals (Magnesium sulphate-$MgSO_4$) for 0.06ac and apply at the rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters per plant every 2 days.
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" by 2" trench **1'** away from the base of the plant because the roots are spread wider than before.	Pour water 3 liters per plant after fertilization

Pest & Diseases Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Aphids (photo 1) • Red pumpkin beetle (photo 2) • Downy Mildew cause Yellow spots (photo 3). • White powdery (photo 4)	• Organic oil and soap spray. Imidachloroprid or Doza application. • Remove egg clusters by hand or spray Chlorantraniliprole or imidacloroprid or Acetamiprid • Spray mancozeb 10 days interval and Unity 10 days interval • Apply Sulphur dust 25lb/acre

1. Aphids

2. Red Pumpkin Beetle

3. Downy Mildew

4. Powdery Mildew

Harvesting	Start harvesting at 45-50 days after transplanting. Picked up the gourd fruits 4-5 days interval regularly. Leaving fruit on the vine will be slow down the plant growth and reduce the crop yield. Harvest in cool temperatures and store in the shade.
Quality Tips	Maintain soil moisture and plant nutrients. Trellising prevents blemishes and rots. Take care to prevent damage during storage.

Bitter Gourd Crop Management Tips		
Crop Variety Selection	Select marketable and high yieldinglocally adapted varieties or hybrids such as Palae EW F1).	
Season preference	Gourds can grow the whole year, however, in the rainy season they may get more leaf diseases.	
Crop Duration	Start harvest 45-50 days after transplanting. Plants duration is 75 – 100 days.	
Yield Expectation	Average yield about 1,530 fruits per 0.06 acre	
Seed requirement	20 g (2 packs), 136 plants per 0.06 acre	
Site selection	Bitter gourds like light well drained soils with high organic matter	
pH	Prefers 6 -7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to9 -12 inches and 2-3 harrowings should be done.	
3 weeks before planting	**Liming:** Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
2 weeks before planting	**Raised Bed Preparation:** Dig raised beds 9-12 inches high, 3 feet wide and 9 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between row furrow irrigation, less evaporation and a greater amount of organic material in the soil.	Moist soil enhances easier bed preparation.
	Row making and plant spacing: In the internal beds, have 2 rows, 2 feet apart. In the outside bed only 1 row in the center of the bed. Space plant 3 feet apart along rows.	Moist soil enhances easier bed preparation.
	Nursery Preparation: Use a 60 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) into the tray. (guidelines in appendix) Plant 1 seed / hole. Plants are ready for transplanting into the field when they are 21 days old at about 4 inches high, or have 4 -5 leaves.	Water every morning for moist soil for seedlings as necessary

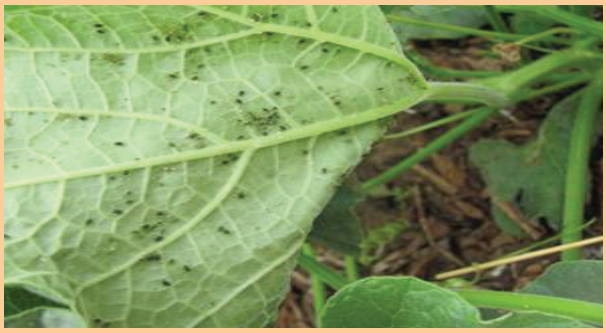
1 week before planting	**Basal fertilizer:** Apply 6 viss /0.06 ac of 15:15:15 compound fertilizer 6 viss and the bokashi compost about 3.5 viss/ 50 feet long bed (37 - 74 viss/0.06 ac) in a 10" x 6" trench along plant rows and then mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 150 ml of Trichoderma solution (7g / 10 litres) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the much.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary.
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. **Direct seeding:** Depth of planting seeds should be 2 times the seed diameter.	Lightly water immediately after transplanting.
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole. **Trellising:** Farmers should erect a trellis 6 feet high made from bamboo or trellis net. (see photo below) 	Pour water 1 liter per plant every second day.
2-4 weeks after planting	**Pruning:** Remove side shoots below 3 feet high. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem weekly. If this does not work well, use chemical control measures as a last option (see photos below)	Pour water 2 liters per plant 2 days interval.
5 weeks after planting	**Weeding:** As required, preferably controlled by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench **6"** from the base of the plant along the whole bed row. Apply Epsom Salt (Magnesium sulphate-$MgSO_4$) 30 ticals /0.06ac and apply at the rate of 1 teaspoonful per plant. For plastic mulch, make a hole between plants to insert the supplementary fertilizer.	Pour water 3 liters / plant every 2 days.
6-9 weeks after planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" x 2" trench along the rows1' away from the base of the plant because the roots are spread wider than before.	Pour water 3 liters/ plant after fertilization

Pest & Diseases Control

Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Aphids (photo 1)	• Organic oil and soap spray. Imidachloroprid or Doza application.
• Red pumpkin beetle (photo 2)	• Remove egg clusters by hand or spray Chlorantraniliprole or imidacloroprid or Fury or Acetamiprid
• Yellow spots (photo 3).	• Spray mancozeb 10 days interval and Unity 10 days interval
• White powdery (photo 4)	• Apply Unity or Sulphur dust 25lb/acre



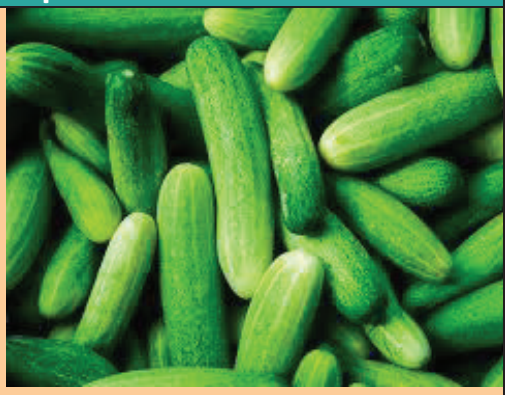
1. **Aphids**

2. Red Pumpkin Beetle

3. Downy Mildew

4.Powdery Mildew

Harvesting	Start harvesting at 45-50 days after transplanting. Pick up the gourd fruits regularly at 4-5 days interval. Leaving fruit on the vine will be slow down the plant growth and reduce the crop yield. Harvest in cool temperatures and store in the shade.
Quality Tips	Maintain soil moisture and plant nutrients. Trellising prevents blemishes and rots. Take care to prevent damage during storage.

Cucumber Crop Management Tips		
Crop Variety Selection	Select marketable and high yielding varieties (locally adapted OP varieties, or hybrids such as Shwe Yati 777, Chia Tai 999, Chia Tai 964,Ngapyut(local))	
Season preference	Cucumber can grow well in dry season. In the rainy season they will get more leaf diseases.	
Crop Duration	Start harvest 45-50 days after transplanting. Crop duration is 90 days.	
Yield Expectation	Average yield about 3,630 fruits per 0.06 acre.	
Seed requirement	10 g (2 packs), 726 plants per 0.06 acre	
Site selection	Cucumber like light well drained soils with high organic matter	
pH	Prefer 5.1 – 5.7	
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand watering. Sprinklers may cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Watering should be gradually increased from transplanting to bud development, flowering and fruit development. It is critical that the plants do not dry out during flowering and fruit development. **Fertigation:** Can be used when using drip.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering**
1 month before planting	**Land Preparation:** Deep plough to9" - 12" and 2-3 harrowings should be done.	
	Liming: Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.	
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist
2 -4 weeks before planting	**Nursery Preparation:** Use a 60 hole nursery tray. Add soil media (the mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) into the tray. (guidelines in appendix) Plant 1 seed / hole. The seeds will germinate after 3-4 days.	
1 week before planting	**Raised Bed Preparation:** Dig raised beds 6-8 inches high, 3 feet wide and2 feet apart. Advantages of raised bed are drainage, aeration, easy root penetration, between row furrow irrigation, less evaporation and a greater amount of organic material in the soil.	

2 days before planting	**Basal fertilizer:** Apply 6 viss of 15:15:15 compound fertilizer and the bokashi compost about 3.5 viss/ 50 feet long bed (37 viss/0.06 ac) into a 10" x 6" trench along the rows and then mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Put one handful of the mixture of 340 g of Trichoderma into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch as this may cause plant disease.	2 days before transplanting, moisten the soil for easy digging and for water for young plants at transplanting as necessary.
Planting Techniques	**Row and Plant Spacing:** Space rows 1.5' apart with 6" to the side of the bed. Space plants 1.5' apart in a zig-zag pattern**.** Plants with 4" height with 3-4 leaves are ready to transplant. **Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes. Plants are ready for transplanting into the field when they are about 4 inches high or have 4-5 leaves. **Direct seeding:** If using direct seeding, the depth of planting seeds should be 2 times the seed diameter.	Lightly water plants immediately after transplanting.
2 weeks after planting	**Trellising:** Cucumber can grow without trellising, however, to get quality fruits, should trellis with bamboo or nets. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage. Weeding Regularly. **Supplementary fertilizer:** Dig a small 2" x 2" trench **3 i**nches from the base of the plant along the whole bed row. Apply 2.5 Viss of Epsom salt (Magnesium sulphate-$MgSO_4$) for 0.06ac at a rate of 1 teaspoonful per plant. **Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole.	Pour water 1 liter per plant every second day.
2-3 weeks after planting	**Pruning:** Remove side shoots below 2 feet height.	Pour water 2 liters per plant every second interval.
4 weeks after planting	**Weeding:** Weed when required, preferably controlled by hand.	Pour water 2 liters per plant every second day.
	Supplementary fertilizer: Apply 15:15:15 compound fertilizer (5 viss per 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" x 2" trench 6" away from the plant row.	
	Pest & Disease control: For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)	

<table>
<tr><td>5 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.
Foliar fertilizer: Evenly apply a solution of 10 tical of Potassium Nitrate (KNO3) in 16 liters of water in the morning.
Supplementary Fertilizer: Dig a small 2” x 2” trench 6 inches from the base of the plant along the whole bed row. Add 2 viss of Epsom salt (Magnesium sulphate-$MgSO_4$) for 0.06ac and apply at a rate of 1 teaspoonful per plant.
For plastic mulch, make a hole equally between plants to insert the supplementary fertilizer.</td><td>Pour water 3 liters per plant every second day.</td></tr>
<tr><td>6-9 weeks after planting</td><td>Weeding: As required, preferably controlled by hand.
Supplementary fertilizer: After first round of picking, apply 6 viss of Compound 15:15:15 fertilizer for 0.06 acre in a small 2” x 2” trench along the rows, 10” from the plants.</td><td>Pour water 3 liters per plant every second day, especially after applying fertilizer.</td></tr>
<tr><td>10-12 week after planting</td><td>Weeding: As required, preferably controlled by hand.
Pest & disease control: As required</td><td>At flowering & fruiting stage pour water 4 liters per plant every second day</td></tr>
<tr><td>12 weeks to harvesting time</td><td>Weeding: As required
Pest & disease control: As required</td><td>Pour water dependent on the soil moisture & weather condition</td></tr>
<tr><td>Pest & Diseases Control</td><td colspan="2">Chemical & Organic Options:
Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

<table>
<tr><th>Description</th><th>Control measure</th></tr>
<tr><td>• Red Pumpkin Beetle (photo 1)
• Thrips damaged symptom (photo 2)
• Downy mildew (photo 3).
•
• White powder on leaf (photo 4)</td><td>• neem extract,
• Imidacloprid, neem extract, Abermectin, soap and oil
• Mancozeb, Dimethomorph, Unity, and Saimoutsana
• Sulphur dust 25 lb/ ac.</td></tr>
</table></td></tr>
</table>

1. Red Pumpkin Beetle

2. Thrips damaged symptom

3. Downy Mildew

4. Powdery Mildew

Harvesting	Pick up cucumber at regularly. Leaving fruit on the vine will be slow down the plant growth and reduce the crop yield.
Quality Tips	High temperature, Low pH, nutrient deficiency and water shortage will lead to bitter cucumbers. Keep soil moisture and plant nutrients. Trellising prevents blemishes and rots.

Watermelon Crop Management Tips		
Crop variety selection	**Grow the marketable variety.** Varieties commonly grown are- **(1) Hera and Hero varieties (Chia Thai)** Skin of Hera is green color with some stripes and that of Hero is dark green color with no stripes. Both can bear 2-3 fruits per plant; fruit size is small, oblong shaped, red fresh, vigorous plant and resistant to long distance transportation damage. **(2) Golden Sweet 80 F1 (EW)** Light green colored skin with dark green stripes, fruit size is medium, oblong shape, bears 2 fruits per plant, resistant to long distance transportation damage, yellow fresh, higher sweetness degree, 6 inches in diameter and 12 inches in length. **(3) 855 (Known You) and Padamyar (EW)** Large sized fruit, bears one fruit per plant, red fresh and higher sweetness degree. Resistant to long distance transport damage.	
Season Preferred	Dry season is the best for planting. Planting in rainy season encourages leave diseases. The best time for Rakhine state is October and November planting.	
Crop duration	Short duration varieties 65-70 DAT, medium duration varieties =75-80 DAT and long duration variety = 90 DAT	
Yield expectation	Short duration varieties 408 fruit/0.06ac, Medium duration varieties =272 fruits/0.06ac and Long duration varieties = 136 fruit /0.06ac	
Seed	Plant population /0.06 ac is 136 plants and seed requirement is 1 packs (20 g) containing around 400 seeds.	
Site selection	Watermelons prefer well drained soil with high content of organic matter.	
pH	6 - 6.8	
Irrigation	Watermelons can be irrigated by furrow irrigation, sprinkler irrigation, drip irrigation and showering method. Young plants need less water than older ones. Save water and labor by using drip irrigation or shower rose in between plant row on top of bed. Furrow irrigation between bed waste water and encourage weeding and leaf disease. Gradually increase watering from planting to fruit set and enlargement.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Deep plough** to 10 inches followed by 2-4 times harrowing to ensure well pulverized soil. Apply 13 viss/0.06 ac of lime for three consecutive years to improve soil pH.	Ensure enough soil moisture for easy cultivation.
2 -3 weeks before planting	**Bokashi making:** Prepare 37 viss/0.06 ac to allow time for fermentation. (guidelines in appendix) **Nursery:** Use a 60-hole nursery tray. Add soil media cow dung 1: garden soil 1: rice husk ash 1). Plant 1 seed 1 hole. (guidelines in appendix) Keep the seedling tray in a well-prepared nursery shade house	Water the seedling every day.
1 week before	**Raised Bed Preparation:** Make raised beds (3 ft wide and 1 ft high	Ensure enough soil

planting	and 9 ft between rows). Advantages of making raised are (1) good drainage, (2) good aeration, (3) easy root penetration, (4) between bed furrow irrigation, (5) reduce evaporation, (6) higher organic material in soil. Width of outermost 2 bed should be 2.5 ft wide. **Basal fertilizer:** Apply 37-74 viss of Bokashi and 3 viss of 15-15-15 compound is applied for 0.06 ac and mixed in the bed. **Row making and plant spacing:** Mark 2 rows spaced 3 ft apart and 6 inches from the edge of the bed. The outermost raised beds will have only 1 row. Mark plant holes 3 feet apart in a zig zag pattern. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 40 ml of Trichoderma solution (7g / 10 liter) into each hole 2 days before transplanting. 1 pack of Tricoderma (150 g) is enough for 0.06 ac. For basal fertilizer application, dig a small 6" depth x 10" wide trench between 2 rows along the whole bed. **Mulching:** Mulch with rice straw 6 " thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch to prevent damage to the stem.	moisture so the fertilizer disolves properly.
Planting Techniques	**Seedlings:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes without breaking the soil ball. Seedlings should be at ground level, not below as this causes water logging and stem disease. Direct seeding technique is not suitable for watermelon.	Water (1 Lit/plant) immediately after transplanting so the soil ball properly exposes to the surrounding soil.
1-2 weeks after transplanting	**Thinning or infilling :** Thin or infill to leave one plant per hole. **Pruning:** For the small and medium fruit size variety, pinch out the growing tips at the 4th-5th leave stage to encourage side shoots. Select the 3 strongest branches and cut the other weak branches. Remove all the shoots below the 10th leaf of these 3 branches. For the large fruit size varieties, remove all the side shoots below the 14th leaf. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage as you may pull out the young plant as well. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)	Lit/plant of water is irrigated every second day. Drip irrigation is the best option for irrigating because the exact amount of water is distributed evenly.
3 weeks after transplanting	**Crop care:** – Make a slope so the vine can easily grow and run on the ground. Spread the dried branches or dried straw on the ground. **Foliar fertilizer application:** Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water.(20 tical is enough for 0.06 ac) At 21 days after transplanting, apply bitter salt at the rate of 1 viss per 0.06 ac in a 2" deep trench between 2 planting rows on the bed.	Make sure that 3 Lit/plant of water is irrigated every second day
4-5 weeks after	**Weeding** as required. **Supplementary fertilizer:** At 30 days after transplanting, Apply 9-	Make sure that 3 Lit/plant of water is

transplanting	25-25 at the rate of 3 viss per 0.06 ac in a trench between 2 planting rows on the bed. For the beds mulched with plastic, apply fertilizer in a hole in the plastic between 2 plants along the planting row. **Fertigation:** If farmers use fertigation, apply plants systematically by dissolving the fertilizers in the irrigation system	irrigated every second day. Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Avoid overflowing the trench and washing the fertilizer away.
6 - 7 weeks	**Plant care:** For the small fruit varieties, get 3 fruit per plant. Get 2 fruits per plant for medium fruit size varieties. ○select the fruit from 13th leaf and onward. Get 1 fruit per plant for large fruit size varieties. Fruit should be selected from 14th-18th leaf. **Weeding** as required. Select egg-size fruit and remove the mis-shaped fruit. After selecting the fruits, apply 3 viss per 0.06 ac of Calcium Nitrate in the trench along the planting row on the beds. Make sure that the small fruits do not expose the ground. Cover the fruit with dried grass/straw to protect from sun-burnt spot. Rotate the fruit regularly. ○Sannitate the field weekly. **Foliar fertilizer application** – Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water. (20 tical is enough for 0.06 C)	Make sure that 3 Lit/plant of water is irrigated every second day. Water requirement get higher as the plants grow. Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Irrigate just enough without overflowing the trench. Do not over water.
8 weeks after transplanting	**Weeding** as required Supplementary fertilizer - Apply 3 viss of 9-25-25 compound fertilizer per 0.06 ac in a 2" deep trench between 2 planting rows on the bed.	Make sure that 4-6 Lit/plant of water is irrigated every second day. Water requirements get higher as the plant grow. Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Irrigate just enough without overflowing the trench.
9-15 weeks after transplanting	**Foliar fertilizer application**: Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water.(20 tical/0.06 ac is enough)	Make sure that 2 Lit/plant of water is irrigated every second day.

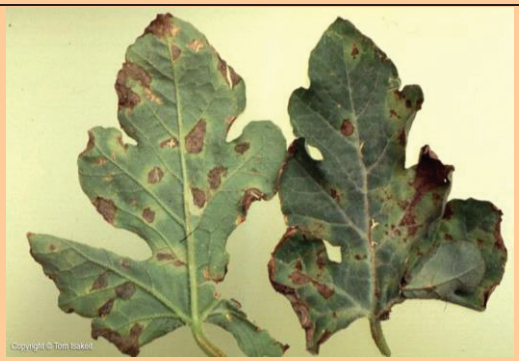
Chemical & Organic Options:

Symptom	Control measure
• Watermelon plant suddenly wilts Photo (1) • White powder on the leave surface Photo (2) • Aphid infestation Photo (3) • Downey disease on leave	• Use resistant varieties and practice crop rotation • Spray difenoconazole • Spray Imidachlorprid 70 WP • Spray Dimethomorph or Synergy containing Mancozeb and Cymoxanil

(1) Fusarian wilt

(2) Powdery mildew

(3) Aphid infestation



(4) Downey mildew

Harvesting: Harvest 30-35 days after pollination when the stem attached to fruit becomes dry, skin hardens, and the fruit gives a deep hollow sound if you give it a thump and a yellow spot appears on the fruit.

Quality: Follow the guidelines I the pictures below for better quality.

Stem attached to fruit become dry

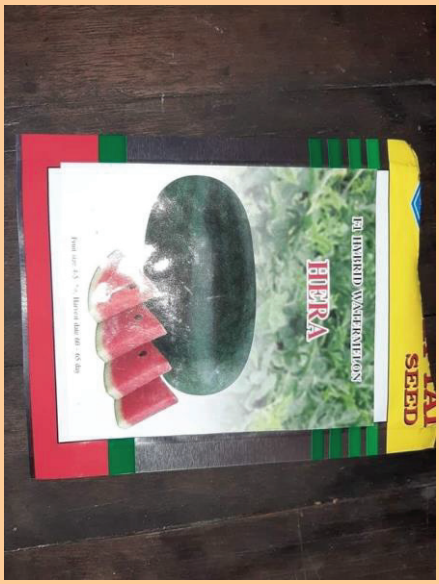
Skin harden

	
Have a deep hollow sound	Yellow spot appeared

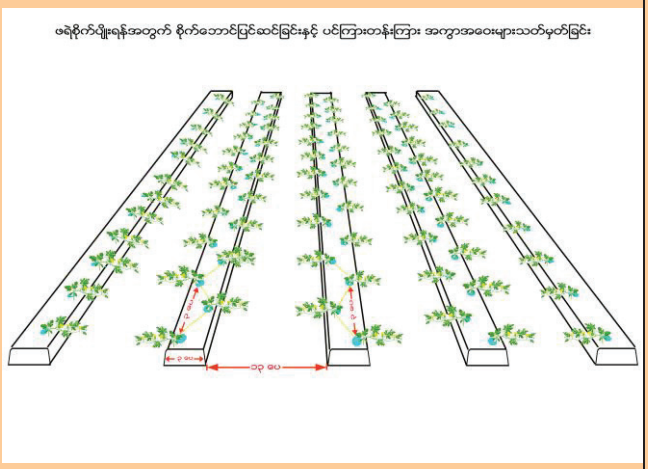
Water Melon varieties Water melon varieties

(1) 855 F1 hybrid variety produced from Known You Seed Companyr

(2) EW's Golden Sweet 80 F1 (medium size)



(3) Chia Thai Company's Hera F1 variety(small size)



(1) **Bed layout**

(2) **Bed layout sample of a farmer**

Pumpkin Crop Management Tips			
Crop Variety Selection	Select marketable and high yielding locally adapted varieties or hybrids such as Seminis-Kyauk Sein (Jade).		
Season preference	Pumpkin can grow the whole year. However, in the rainy season they will get more leaf diseases.		
Crop Duration	100-120 days after planting. Early variety can be harvested about 100 days after planting while late variety can be harvested about 120 days after planting.		
Yield Expectation	Average yield 256 fruits / 0.06 acre		
pH	Prefers 5.5 - 7		
Seed requirement	20 packets (8 seeds/pkt) / 0.06 acre; 128plants per 0.06 acre		
Site selection	Pumpkins like light well drained soils with high organic matter		
Irrigation	For large areas, use furrow irrigation, shower rose, or drip irrigation. For smaller areas, use hand water. Sprinkler will cause leaf diseases. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds wastes water and encourage weeds and leaf diseases. Gradually increase watering during the early stages on to runner formation, bud development, flowering and fruit development. **Fertigation:** Can be used when using drip.		
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit).**	**Watering:**	
1 month before planting	**Land Preparation:** Deep plough to 9-12 inches and 2-3 harrowings should be done.	Damp soil is easier to cultivate	
	Liming: Apply 13 viss of lime /0.06 ac /year for 3 consecutive years.		
	Bio fertilizer like Bokashi Compost & Fish Amino Acid & Bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition. (guidelines in appendix)	Keep Bokashi moist	
	Raised Bed Preparation: Prepare the beds with 3 feet width, 9-12 inches high and 9 feet apart from each bed. The advantages of raised bed are as follows; (1) Good drainage, (2) Good soil aeration, (3) easy root penetration, (4) can furrow irrigation between beds, (5) less evaporation, and (6) increase organic materials in soil. **Row making and plant spacing:** In the internal beds, have 2 rows 2 feet apart and 6" form the side of the bed. In the outside bed have only 1 row in the center of the bed. Space plants 3 feet apart in the rows.	Water every morning for moist soil	

	Nursery Preparation: Use a 60 hole nursery tray. Add soil media (a mixture of garden soil, well decomposed cow dung and burned rice husk at a ratio of 1:1:1) into the tray. (guidelines in appendix). Plant 1 seed per hole. Plants are ready for transplanting into the field when they are 4 inches high or have 4-5 leaves.	Water every morning to make soil damp but not too wet.
1 week before planting	**Basal fertilizer:** Apply 6 viss per 0.06 ac of 15:15:15 compound fertilizer with the Bokashi compost about 3.5 viss per 50 feet long bed (37 – 74 viss per 0.06 ac) in a 10" x 6" trench along the rows, then mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth at the required pant spacing. Pour half tin of Trichoderma solution (7g per 10 liters of water) into each hole 2 days before transplanting. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Notice not to touch the stem of the plant with the mulch as it may cause plant disease.	2 days before transplanting, moisten the soil for easy digging and water to young plants at transplanting as necessary
Planting Techniques	**Transplanting:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes with the seedlings at ground level. Not below ground level where water can accumulate stopping aeration and may cause plant disease. **Direct seeding:** Depth of planting seeds should be 2 times their diameter.	Lightly water immediately after transplanting
1 week after planting	**Thinning or infilling:** Thinning or infilling is required to leave 1 strong plant per hole.	Pour water 1 liter per plant every second day.
2- 4 weeks after planting	**Pruning:** Remove side shoots as necessary. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM5 and Neem. If this does not work well, use chemical control measures as a last option (see photos below) **Supplementary Fertilizer**: Dig a small 2" x 2" trench **6** inches from the base of the plant along the whole bed row. Add 2 viss of Epsom salt (Magnesium sulphate-$MgSO_4$) for 0.06ac and apply at a rate of 1 teaspoonful per plant.	Pour water 2 liters per plant every second day.
5-8 Weeks after Planting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" x 2" trench **6"** away from the base of the plant. **Fertigation:** Can be used when using drip.	Pour 2 - 3 liters of water per plant every second day.
9 weeks after panting until harvest	**Weeding:** As required, preferably by hand Pruning: Remove the undesired small fruits leaving only 1-2 fruits per plant. **Supplementary fertilizer:** Apply 9:25:25 compound fertilizer (3.5 viss/ 0.06 ac) with 1 tablespoonful (about 10 g) per plant in a 2" x 2" trench **1'** away from the base of the plant because the roots are	Pour 2 - 3 liters of water per plant every second day.

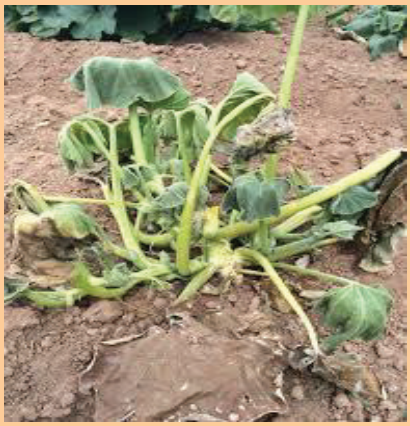
	spread wider than before.	
9 weeks to Harvesting	**Weeding:** As required. **Pest & disease control:** As required**.**	**Watering depend on the Soil and weather condition**

Pest & Diseases

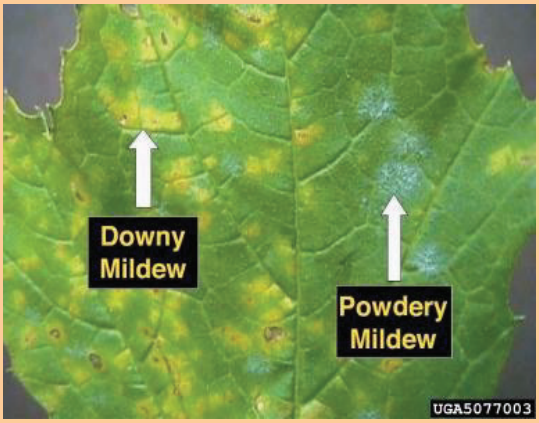
Chemical and Organic Options:

Inspect plants regularly for signs of pests and diseases. Look at both sides of the leaves and the stem. If organic control measures do not work well, use chemical control measures.

Description	Control measure
• Fusarium Wilt (photo 1) • Downy Mildew and powdery mildew (photo 2) • Fruit fly (photo 3) • Red pumpkin beetle (photo 4).	• Resistant varieties; crop rotation or Kasugamycin chemical application) • Spray Mancozeb Chlorothalonil or Sulphur for mildew. (Unity fungicide) • Remove plant and look for presence of beetles, Spray Chlorantraniliprole. • Methyl-eugenol or Abamectin



Fusarium Wilt (photo 1)



Downy Mildew (photo 2)

Fruit Fly (photo 3)

Red Pumpkin Beetle (photo 4)

Harvesting - It is time to harvest when the stem starts to dry.

Quality Tips: Move pumpkins around to get even sun for even color. Keep away from contact with the soil as this discolors the pumpkin. Pumpkins will keep for many weeks in the shade. Pack with dry grass for transporting.

Peanut Crop Management Tips		
Variety Selection	Select market demanded, high yielding and disease & pest resistant varieties. eg. - Sinpadaythar 6, Sinpadaythar 7, Sinpadaythar 11 and Local variety.	
Season Preference	Late monsoon and early winter	
Crop Duration	90 - 105 days	
Estimated Yield	50-60 baskets per acre. Higher on alluvial soils.	
Seed Rate	6 baskets (pods) per acre	
Site Selection	Groundnut thrives well in a wide variety of soils with good drainage and aeration.	
pH	Prefer 5.5.-7	
Irrigation Method	Generally not required. If water shortage, use furrow or sprinkler irrigation.	
Time for Operation	General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)	**Watering**
1 month before planting	**Land preparation:** Deep plough at 9-12 inches and 2-3 times of harrowing should be done. **Liming-** Add 200 viss of lime per acre per year for three consecutive years. Although liming can improve the yield, its cost and benefit should be considered.	Moist soil makes land preparation easier.
3 weeks before planting	**Bokashi compost** should be prepared at 400-800 viss/ac. (guidelines in appendix)	A moist bokashi mix is preferred.
One week before planting	**Basal fertilizer:** Apply 4 viss of Urea, 10 viss of T- super and 4 viss of Potash per acre by broadcasting and then mix into the soil. Add bokashi compost about 400-800 viss/ac and 25 kilograms of trichoderma per acre and then mix into the soil.	Before planting, an even distribution of water is required. Too much water restricts good cultivation.
Planting techniques	**Land preparation:** Level the soil after two times of harrowing. **Direct seeding:** Before planting, treat the seeds with one pack of Rhizobium. Sow seeds with row spacing 12" and plant spacing 6" or row spacing 15" and plant spacing 4". Seeds should be 1"- 2" deep.	At seeding time, it is important to have enough soil moisture but not too much as very wet soil limits germination.
1-2 weeks after planting	**Seed emergence** starts at about 6-8 days after sowing. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Weeding is especially important at younger plant stage.	Maintain soil moisture to be enough for plant growth.

3 weeks after planting	**Weeding:** Weed when required.	Irrigate every second week if moisture is not enough.
	Pest & disease control: For prevention, use organic methods like EM 5 and neem pesticide. If this does not work well, use chemical control measures as a last option (See photos below.) **Foliar fertilizer:** Spray (Cormet Beta) 2 times at 50 CC per 4 gallons (250 CC per acre) until flowering stage for vegetative growth.	
4-6 weeks after planting	**Weeding:** Weed when required. **Pest & Disease control –** monitor and control regularly (as described below) **Supplementary fertilizer:** Spread 125 Kg (5 bags) per acre of gypsum at the base of the plant just before flowering to support pod formation. **Foliar fertilizer:** At the flowering stage, spray (Cormet Ar Kaung) 3 times at 35 g (2 tical) per 4 gallons. (175 g/ac) every 7 days interval to promote reproductive growth. **Earthing up**: After applying gypsum, make earthing up by inter-row cultivation so pegs come in contact directly with the gypsum.	The gypsum can be washed into the soil with the excess water from the foliar spray.
7-14 week after planting	**Pest & Disease control –** monitor and control regularly (as shown below)	Water in every second week if moisture is not enough.

From flowering to pods formation stages

Flower

Pegging stage

Pod initiation at the apical end

Pests & Diseases Control

Chemical and Organic Options: Inspect for pests and diseases on the upper and lower leaf surface regularly.

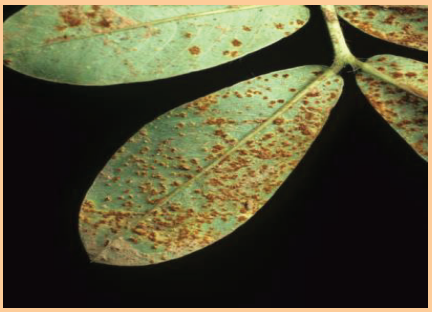
Description	Control Measure
• Leaf curling (Photo No.1) • Attack throughout the crop period. Caterpillars penetrate into the leaves. (Photo No.2) • Plants die off by wilting and drying (Photo No.3) • Yellowish circles or brown spots on the leaves and falling off leaves (Photo No.4) • Red or black blotchy on the surface of lower leaves are found and plants gradually die off. (Photo No.5) • Fungus diseases may be found throughout the crop period. (Photo No.6)	• Spray Acephate • Spray neem extract and Imidachloprid insecticides. • Use seed treatment with Gaucho. Deep ploughing. • Spray Trichoderma solution. Use crop rotation. Spray Mencozeb. • Remove the plant debris from the field. Spray Mencozeb two weeks interval. • Use seed treatment (e.g. Thirum)

Leaf binder

2. Leaf miner grub

3. Ground Chafer/White

4. Brown spot



5. Rust

6. Collar rot

Harvesting and post-harvest management

Prevention of Aflatoxin

Aflatoxin affected peanut pods are very toxic and any kind of plant part that shows affected symptoms should be removed. To reduce the occurrences of this fungus,

- The soil should not be too dry at 4 weeks before harvesting.
- Place harvested plants upside down for drying. After that, pluck the pods as early as possible. And then, sun dry the pods on a drying floor or tarpaulin sheet. Rotate the pods regularly to even sun drying.
- Remove fungus infected pods.

Fungus effected pods

Good quality pods

Harvesting	Start harvesting when 75 % of the leaves turn yellow color.
Quality Tips	Select uniform seeds in size. Remove discolored and broken pods/seeds to get even quality and better price.

Corn Crop Management Tips		
Variety Selection	Select marketable and high yielding varieties. Although hybrid corn provide high yields, they require large amounts of fertilizer and water. Varieties currently sown are Pan-Gold, Pan-75, Pan-color 5 and Pan-White.	
Season Preference	Sweet corn should be grown at post monsoon season (Oct – April). Seed germination and vegetative growth should be assured with enough residual soil moisture or irrigation.	
Crop Duration	Depending upon the variety and climate, ears may be harvested 70 – 90 days after seeding.	
Estimated Yield	Average harvested yield is 17,424 ears per acre.	
Seed Rate	Seed requirement for Pan Color 5 is 9-12 packets (500 g)/ac. Pan Gold variety requires 7-8 packets (500 g)/ac.	
Site Selection	Although sweet corn thrives well in a wide variety of soils, it does not like water logging and performs best in sandy loam soil.	
Soil pH	Prefers 5.8 – 6.8	
Irrigation	Corn can be irrigated by furrow irrigation or drip irrigation. Drip irrigation is the most suitable method for water use efficiency. Young plants need less water than older ones. Save water and labor by using drip irrigation or shower rose in between plant rows on top of the bed. Furrow irrigation between beds wastes water and encourages weed growth. Corn requires less water for young plants but demand increases as leaf area increases. Water shortage during the flowering period causes a reduction in yield because the female flowers dry out and do not pollinate properly and the male flowers release their pollen too early.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
One month before planting	**Land preparation:** Deep plough to 9-12 inches and 3-4 times harrowing should be done.	Moisten the soil for easy ploughing and harrowing.
3 week before planting	**Liming:** Add 200 viss of lime per acre per year for three consecutive years. **Prepare EM Bokashi** compost 400-800 viss/acre 3 weeks before planting to allow for fermentation. (guidelines in appendix)	Ensure enough soil moisture.
2 weeks before planting	**Raised bed preparation:** Make raised beds 3 feet wide and 8 inches high and 1.5 feet apart. Advantages of making raised beds are (1) good drainage, (2) good aeration, (3) easy to root penetration, (4) between beds furrow irrigation (5) reduction in evaporation and (6) high organic matter in soil.	Moisten the soil for easy bed preparation.

1 week before planting	**Basal fertiizer application:** Apply 30 viss/ac of 15-15-15 compound fertilizer and 400-800 viss/ac of bokashi at the time of bed preparation and mix thoroughly.	Moisten the soil for easy planting 2 days before planting.
Planting technique	**Row making and plant spacing:** In the beds, make 2 rows 2 feet apart and 6 inches to the outside of the row. Plants should be 1 foot apart following a zigzag pattern. **Mulching**: To prevent weeds, protect soil temperature, prevent soil disease spreading to the plant and prevent soil erosion, mulch the beds with straw or plastic mulch. **Direct seeding**: Seeds can be sown directly at a depth of 1/4 inches with spacing 1 foot apart.	Moist soil encourages germination.
1-2 weeks after sowing	**Thinning or infilling:** Thin if more than one seed per hole, or infill to leave 1 strong and healthy plant per hole.	4 liters per square yard every 3 days.
3-4 weeks after planting	**Weeding**: Remove weeds to prevent nutrient competition and host for pests and diseases. **Pest and disease control:** Spray EM 5 or neem pesticide at 1 week intervals and EM 5 as a repellant every third day. As the last option, use chemical spray (see below). **Supplementary fertilizer:** Dig a small 2" x 2" trench at the center of two rows along the whole bed row. Apply 30 viss of urea and 30 viss of 9:25:25 compound fertilizer per acre along the trench. Cover the fertilizer with soil. Water if the soil is dry. If the bed is mulched with plastic sheet, make holes between each plant for fertilizer application. If drip irrigation method is used, fertigation can be practiced.	After putting fertilizer, 20 liters per square yard every 3 days.
5-6 weeks after planting	**Weeding**: Remove weeds to prevent nutrient competition and host for pests and diseases. **Pest and disease control:** Spray EM 5 or neem pesticide at 1 week intervals and EM 5 as a repellant every third day. As the last option, use chemical spray (see below).	20 liters per square yard every 3 days.
7-10 weeks after planting	**Weeding:** Preferably control by hand as necessary. **Pest and disease control:** Spray EM 5 or neem pesticide at 1 week intervals and EM 5 as a repellant every third day. As the last option, use chemical spray (see below).	60 liters per square yard every 3 days.
11 -12 weeks after planting	Corn can be harvested at about 11 weeks after planting.	Reduce watering towards harvest to around 25 liters per square yard every 3 days.

Female flower (silk)

Male flower (tassel)

Planting on bed in zigzag pattern

Pests & Diseases Control

Inspect for pest and disease symptoms on both sides of the leaves.

Chemical and Organic Options:

Descriptions	Control measure
• Leaf blight	• Remove the disease infected leaves. Spray (Carbendazim and Hexaconazole)
• Stem rot and plant dying off	• Remove the disease infected plant and rotate the crop.
• Army worm infestation	• Spray prevathon ,B.t , Thiamethoxam or Alam pesticides

1. Leaf blight symptom

2. Stem rot disease

3. Army worm infestation

Harvesting	Corn can be harvested at about 11 weeks after planting. when the tassel turns brown and dry.
Quality Tips	Enough irrigation is essential to get fully filled grain at the time of female flowering.

Chili Crop Management Tips		
Variety Selection	Choose market demanded varieties. If hybrid varieties are chosen, study the resistance of pest and disease of the individual crops. General characteristics of 2 varieties are described below. Local varieties are often preferred by consumers ahead of hybrids.	
	Tongla (692) Strong plant stem and large canopy, the fruit is jade color, upright fruiting habit, high fruit yield, very spicy taste, susceptible to wilt diseases and higher water requirement. **Demon** Plant is short compared to Tongla (692), fruit in light green color and upright fruiting habit, high fruit yield, taste spicy, resistance to wilt diseases, lower water requirement compared to Tongla (692).	
Season Preference	In dry season, yield is increased and disease infection is reduced. Although chili can grow throughout the year in central parts of Myanmar, enough irrigation water should be ensured in hot season.	
Crop Duration	First harvesting of Tongla and Demon varieties can be started 50-55 days after transplanting. Depending upon the soil fertility, harvesting can extend 5-6 months after transplanting.	
Expected Yield	Hybrid average plant population is 5,808 plants /ac. Average green yield is 3,485 viss/ac (60 ticals/plant). Yield may be higher than this amount if chili is grown in fertile soil. Local variety average plant population is 11616 plants /ac. Average yield green is 1742 viss/ac (15 ticals/plant). Yield may be higher than this amount if chili is grown in fertile soil.	
pH	Prefer 5-5.7	
Seed Rate	Amount of seed required/ac is 5 packets (5 g) for both of Tongla and Demon varieties. For local variety, seed requirement 5 tical per ac.	
Site Selection	Although chili thrives well in a wide variety of soils, it does not like water logging. Sandy loam soil with good aeration and drainage is the best.	

Irrigation	Chili can be irrigated by furrow, sprinkler, drip and showering methods. If sprinkler irrigation is used, you can consider the cheaper sprinkler irrigation pipes (with many small holes along the pipe and water coming out from that holes evenly. The amount of water can be adjusted so the water sprinkles around the base of the plant between two planting rows. The cheap sprinkler materials are easily available in Myanmar. Young plants need less water than older ones. Save water and labor by using drip irrigation or shower rose in between plant rows on top of the bed. Furrow irrigation between beds wastes water and encourages weed growth and leaf disease. Watering should be gradually increased from planting to fruit setting and development.	
Time of Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Irrigation**
One month prior to planting:	Plough the soil to 12 inches depth because of the deep rooted system of chili. Harrow 3-4 times to get well pulverization fine textured soil.	Moist soil facilitates harrowing.
3 weeks before planting:	**Liming:** Add lime 200 viss per acre per year for three consecutive years. **Bokashi compost:** Make 400-800 viss/ac EM Bokashi, Fish Amino and EM 5 (guidelines in appendix) **Nursery establishment**: 105 - hole nursery seed trays or seedling bags. Add soil media (a mixture of garden soil, well decomposed cow dung and biochar at a ratio of 1:1:1) in the tray. Local varieties have many plants per acre so to save costs, seeds can be sown directly into the ground instead of seedling trays. Seedlings can be transplanted 25-30 days after sowing.	Irrigate or pour water daily in the morning.
1 week before planting	**Raised Bed Preparation:** Make raised beds 3 ft wide and 1 ft high and 1.5 ft between rows. **Make raised beds** 3 feet wide, 8 inches high and 2 feet apart. Advantages of making raised beds are (1) good drainage, (2) good aeration, (3) easy root penetration, (4) between beds furrow irrigation, (5) reduction in evaporation and (6) high organic matter in soil. **Row making and plant spacing:** On the beds, make 2 rows 2 feet apart and 6" to the outside of the bed. Hybrid plants should be 3 feet apart while local varieties 1.5 feet apart, both varieties should be planted in a zigzag pattern.	2 days before transplanting, moisten the soil for easily digging and easily transplanting as necessary.

	Basal fertilizer: Apply 45 viss of 15:15:15 compound fertilizer per acre and 400-800 viss/ac of bokashi compost, in a 10" x 6" trench along the plant rows, and then thoroughly mix into the soil. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 40 ml of trichoderma solution (7 g / 10 liters) into the hole 2 days before transplanting. Three packets of trichoderma (150 g) are enough for 1 ac. **Mulching:** Mulch with rice straw 6 "thick or plastic sheet on the raised bed to reduce losses of soil moisture, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch.	
Planting techniques	**Seedlings:** Carefully transplant 1 healthy seedling into each of the seedling holes without breaking the roots. Keep seedlings at ground level, not below as this can cause water to accumulate causing stem disease. **Direct seeding** technique is not suitable for chili.	Lightly water the plants immediately after transplanting.
1 week after transplanting	**Thinning or infilling:** If more than one seed was used per hole or bag, thinning is required. If some plants die, infilling is needed to leave 1 strong plant per hole.	Pour one liter of water per plant every second day.
2 weeks after transplanting	**Pruning:** No need to do side shoots removal and topping. Remove the first set of fruit so as not to be weaken the young plant. **Weeding:** Weeding when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding especially at young plant stage. **Pest & disease control:** For prevention, use organic methods like EM 5 and neem or killing pest by hand every week. If this does not work well, use chemical control measures as a last option (see photos below).	Pour two liters of water per plant every second day.
3 weeks after transplanting	**Weeding:** As required, preferably by hand.	Pour two liters of water per plant every second day.

4 weeks after transplanting	**Weeding:** As required, preferably by hand. **Supplementary fertilizer:** Dig a small 2" x 2" trench 6 inches from the base of the plant along the whole bed row. Apply 45 viss of 15-15-15 compound fertilizer in the trench. Cover the trench with soil and provide water if the soil is dry.	Irrigate every 4th day at 7 liter per plant. (Refer to soil moisture testing guide attached in this CMT book.)
5-7 weeks after transplanting	**Weeding:** As required, preferably by hand. **Foliar fertilizer:** Dissolve 10 ticals of Potassium Nitrate (KNO_3) in 4 gallons of water and spray on the leaves in the morning. For 1 ac, use 5 x 4 gallon knapsack sprayers with a total 50 ticals of Potassium nitrate/ac. Apply 30 viss of Calcium Nitrate fertilizer in the trench. Cover with soil and provide water if the soil is dry.	
8-10 weeks after transplanting	**Weeding:** As required, preferably by hand. **Foliar fertilizer:** Dissolve 10 ticals of Potassium Nitrate in 4 gallons of water and spray on the leaves in the morning. Use 50 ticals of Potassium Nitrate/ac (5 x 4 gallon knapsack sprayer).	Irrigate every 4th day at 9 liter per plant (Refer to soil moisture testing guide attached in this CMT book.)
11 weeks after transplanting	**Supplementary fertilizer:** Dig a small 2" x 2" trench between the 2 rows along the whole bed . Apply 30 viss of 15-15-15 compound fertilizer in the trench. Cover with soil and provide water if the soil is dry.	Irrigate immediately after applying fertilizer. Irrigate every 4th day at 10 liter plant (Refer to soil moisture testing guide attached in this CMT book.)

12-15 weeks after transplanting	**Supplementary fertilizer:** Dig a small 2" x 2" trench between the 2 rows along the whole bed . Apply 30 viss of Calcium Nitrate fertilizer in the trench. Cover with soil and provide water if the soil is dry.	Irrigate immediately after applying fertilizer. Irrigate every 4th day at 7 lit per plant (Refer to soil moisture testing guide attached in this CMT book.)

Pests and Diseases

Chemical & Organic Options:

Descriptions	Control measures
• Sucking insects (Thrips, Aphid, White Fly.(Photo No. 1)	• Spray Imidachlorprit (70 WP)
• Fruit borer (Photo No. 2)	• Spray neem extract or EM 5 solution for prevention at weekly intervals. Spray Alan insecticide (follow the instruction on the container)
• Anthracnose (Photo No. 3) • Wilt diseases. (Photo No. 4)	• Spray "Unity" fungicide. • Uproot and burn. Use crop rotation. • Spray "Demax and Labilite" fungicide.

(1) Aphid

(2) Fruit borer damage

(3) Anthracnose

(4) Chili wilt disease

Harvesting/picking	Depending upon the market, chili can be harvested green at weekly intervals or left to ripen for sale as fresh red chili or dried red chili.
Quality Tips	Late application of nitrogenous fertilizers prolongs vegetative growth. Excess irrigation at ripening stage may lead to rotten fruit.

Onion Crop Management Tips		
Variety selection	Select market demand and disease resistant varieties. Suitable local varieties that are grown include Shwe Pha Lar local variety, Baung Zauk local variety, Nasik red F-1 Indian variety.	
Season Preference	Onion can grow well from late monsoon to winter (September to December). Dry season is more preferred for harvesting.	
Crop duration	90-150 days after transplanting.	
Expected Yield	3,500 viss per ac.	
Seed requirement	Amount of seed required is 20 tins/ac (2.5 pyi per ac)	
Site selection	Onion can be grown in most types of soil. It does not like water logging. Sandy loam soil with good drainage is the best.	
pH	Prefers 6-7	
Irrigation	For large areas, use furrow irrigation, shower rose, drip or sprinkler irrigation. Sprinkler irrigation is the most suitable for onion. For wider area, lower cost hand watering or shower rose irrigation between bed rows can be practiced. (1) Young plants need less water than older plants, (2) Save water and labor by using drip or shower rose in between plants rows on top of beds, (3) Furrow irrigation between beds waste water and encourage weeds and leaf diseases. Onions have small root systems and need regular watering. It is critical that plants do not dry out during bulb enlargement. Watering should be stopped 3 weeks before harvesting to hasten maturity. **Fertigation:** Can be used when using drip.	
Time for operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 Month before transplanting:	**Land preparation:** Cultivate the soil to 9-12 inches. Harrow 2-3 times to get well pulverized soil because of shallow rooted system. **Liming:** Add lime 200 viss/ac/ year for 3 consecutive years.	Moisten soil for ease of cultivation
	Bio fertilizer like Bokashi compost & Fish Amino Acid & bio pest control like EM5 should be prepared 3 weeks before planting to allow good decomposition.	Keep Bokashi moist

	Nursery establishment: Well decomposed cow-dung (2-4 baskets): burnt rice husk (2-4 baskets) and loamy soil (1-2 baskets) should be mixed with compound 15:15:15 (0.5 viss) and applied thoroughly on 30 % shaded bed (3' width x 50' length). Gently compact the bed soil and level evenly. Onion seeds are broadcasted evenly on the bed and covered with sand (or) burnt rice husk and water. Seedlings are ready to transplant after 25-45 days after sowing. It needs 0.05 ac of nursery area for 1 acre (11 x 50ft x 3 ft beds)	Water nursery bed every day in the morning.
1-2 weeks before transplanting	**Raised bed preparation**: Make raised beds spaced 1.5 feet apart, 3 feet in width and 6-8 inches in height.	2 days before transplanting, moisten the soil for easy
	Basal fertilizer: Mix in the soil 30 viss of 15:15:15 compound fertilizer and **Bokashi compost** about 400-800 viss/ac, along with Gypsum 61 viss/ acre.	digging and to provide water for young plants at transplanting.
Planting Techniques	**Row and plant spacing:** Rows spaced 6" wide and onions 4" apart. The depth needs about 1". Use modified rake to make lines for transplanting.	Lightly water the plants immediately after transplanting
1 week after transplanting	**Thinning or infilling:** Because of transplanting method, onions do not need thinning but infilling should be done. **Mulching:** Mulch with rice straw 6" thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the much to prevent stem disease occurring.	Water every 2nd day 1 liter per ft of bed.
2-4 weeks after transplanting	**Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem weekly. If this does not work well, use chemical control measures as a last option (see photos below)	Water every 2nd day 1 liter per ft of bed.
5-6 weeks after transplanting:	**Weeding:** 5-6 weeks after transplanting is critical time for weeding. **Supplementary fertilizer:** Dig a small 2" x 2" trench along the rows. Apply 30 viss of 20-10-10 NPK compound fertilizer. Apply Potassium Nitrate in the morning with the rate of 10 tical/4 gal sprayer. 1 viss of Potassium Nitrate is needed for one 1 ac.	Depend upon weather and soil moisture condition, Water every week 3 liter per ft of bed.

7-8 weeks after transplanting	**Weeding:** Weed as needed. **Supplementary fertilizer:** In small 2' x 2" trench beside rows, apply 30 viss of 15-15-15 NPK compound fertilizer per ac and 31 viss of gypsum per ac at 7 weeks after transplanting. At 8 weeks after transplanting, apply potash fertilizer (30 viss/ac) to improve bulb quality and prolong shelf life. Also spray Potassium Nitrate (KNO3) in the morning at a rate of 10 tical/4 gal sprayer. 1 viss of Potassium Nitrate is needed for one 1 ac. **Pest & Disease control:** If infection symptoms are found, effectively control on time as directed in Pest & Disease control below.	Depend upon weather and soil moisture condition. Irrigate every week/immediately after fertilizer application. Estimated water requirement is 3 liter per ft of bed
9-15 weeks after planting	**Weeding:** Weed carefully around bulbs. **Pest & Disease control:** When needed – see details below.	Depend upon weather and soil moisture condition, Irrigate every week. Estimated water
		requirement is 4-liter ft of bed. Amount of irrigation water should be reduced as the plant approach harvesting
15 weeks after transplanting to harvesting	**Weeding: A**s needed **Pest and disease control:** When needed – see details below.	Minimize irrigation water amount to 1 lit per ft of bed/week Irrigation should be stopped 15 days before harvesting.

Pests and diseases control

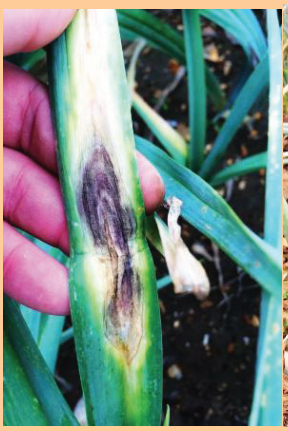
Chemical & Organic Options:

Inspect pests and diseases symptoms regularly. For prevention, use organic methods like EM 5 and Neem weekly. If this does not work well, use chemical control measures as a last option

Description	Control measure
• Thrips and damage symptoms. (Photo No. 1) • Leaf miner. (Photo No. 2)	• Chlorantraniliprole (Prevathon) . • Imidacloprid (Doza), Abametin (Demon),
• Purple blotch fungal disease (Photo No. 3) • Botrytis bulb rot fungal disease (Photo No-4)	• Apply potash. Use Iprodione (Rovral) Azoxystrobin+Difenoconazole (Unity). • Avoid using over urea fertilizer. Spray chlorothalonil, unity at 10 days interval. • Use resistance varieties. Eradicate diseased plants and apply crop rotation. • Try to be good ventilation between plants.

Thrips and damage symptoms (Photo No. 1)

Leaf miner. (Photo No. 2)




Purple blotch fungal disease (Photo No. 3)


Botrytis bulb rot fungal disease (Photo No-4)

Harvesting	When two thirds of leaves fall down, onion harvest can start. Watering should be cut before harvesting to hasten maturity.
Quality guidelines	Take care not to damage bulb during storage. Storage house should have a high roof and be well ventilated. Storage piles should not be more than 6” thick.

Watermelon Crop Management Tips		
Crop variety selection	**Grow the marketable variety.** Varieties commonly grown are- **(1) Hera and Hero varieties (Chia Thai)** Skin of Hera is green color with some stripes and that of Hero is dark green color with no stripes. Both can bear 2-3 fruits per plant; fruit size is small, oblong shaped, red fresh, vigorous plant and resistant to long distance transportation damage. **(2) Golden Sweet 80 F1 (EW)** Light green colored skin with dark green stripes, fruit size is medium, oblong shape, bears 2 fruits per plant, resistant to long distance transportation damage, yellow fresh, higher sweetness degree, 6 inches in diameter and 12 inches in length. **(3) 855 (Known You) and Padamyar (EW)** Large sized fruit, bears one fruit per plant, red fresh and higher sweetness degree. Resistant to long distance transport damage.	
Season Preferred	Dry season is the best for planting. Planting in rainy season encourages leave diseases. The best time for Rakhine state is October and November planting.	
Crop duration	Short duration varieties 65-70 DAT, medium duration varieties =75-80 DAT and long duration variety = 90 DAT	
Yield expectation	Short duration varieties 5,808 fruit/ac, medium duration varieties =4,356 fruits/ac and long duration varieties = 2,904 fruit /ac	
Seed	Plant population /ac is 2,904 plants and seed requirement is 8 packs (20 g) containing around 400 seeds.	
Site selection	Watermelons prefer well drained soil with high content of organic matter.	
pH	Prefers 6 - 6.8	
Irrigation	Watermelons can be irrigated by furrow irrigation, sprinkler irrigation, drip irrigation and showering method. Young plants need less water than older ones. Save water and labor by using drip irrigation or shower rose in between plant row on top of bed. Furrow irrigation between beds waste water and encourage weeds. Gradually increase watering from planting to fruit set and enlargement.	
Time for Operation	**General Field Work Requirements (Note: Study your location's specific requirements and adjust these recommendations to suit)**	**Watering**
1 month before planting	**Deep plough** to 10 inches followed by 2-4 times harrowing to ensure well pulverized soil. Apply 200 viss/ac of lime for three consecutive years to improve soil pH.	Ensure enough soil moisture for easy cultivation.
2 -3 weeks before planting	**Bokashi making:** Prepare 400-800 viss/ac to allow time for fermentation. (guidelines in appendix) **Nursery:** Use a 60-hole nursery tray. Add soil media cow dung 1: garden soil 1: rice husk ash 1 – guidelines in appendix). Plant 1 seed 1 hole. Keep the seedling tray in a well-prepared nursery shade house	Water the seedling every day.
1 week before	**Raised Bed Preparation:** Make raised beds (3 ft wide and 1 ft high	Ensure enough soil

planting	and 9 ft between rows). Advantages of making raised are (1) good drainage, (2) good aeration, (3) easy root penetration, (4) between bed furrow irrigation, (5) reduce evaporation, (6) higher organic material in soil. **Basal fertilizer:** Apply 400-800 viss of Bokashi and 45 viss of 15-15-15 compound per acre in a 10" x 6" trench along the rows and then mixed in the soil. **Row making and plant spacing:** Mark 2 rows spaced 2 ft apart and 6 inches from the edge of the bed. The outermost raised beds should have only 1 row. Mark plant holes 3 feet apart in a zig zag pattern. **Digging holes:** Dig holes about 6" in diameter and 6" in depth. Pour 40 ml of Trichoderma solution (7g / 10 liter) into each hole 2 days before transplanting. 3 pack of Tricoderma (150 g) is enough for 1 ac. **Mulching:** Mulch with rice straw 6 " thick or plastic sheet on the raised bed to reduce soil temperature, prevent weeds, soil disease spreading to the fruit and erosion. Try not to touch the stem of the plant with the mulch to prevent damage to the stem.	moisture so the fertilizer dissolves properly.
Planting Techniques	**Seedlings:** Carefully (without breaking the roots) transplant 1 healthy seedling into each of the seedling holes without breaking the soil ball. Seedlings should be at ground level, not below as this causes water logging and stem disease. Direct seeding technique is not suitable for watermelon.	Water (1 Liters/plant) immediately after transplanting so the soil ball is properly exposed to the surrounding soil.
1-2 weeks after transplanting	**Thinning or infilling:** Thin or infill to leave one plant per hole. **Pruning:** For the small and medium fruit size variety, pinch out the growing tips at the 4th-5th leave stage to encourage side shoots. Select the 3 strongest branches and cut the other weak branches. Remove all the shoots below the 10th leaf of these 3 branches. For the large fruit size varieties, remove all the side shoots below the 14th leaf. **Weeding:** Weed when required to stop weeds taking nutrients and providing a home for pest and disease. Take care with weeding at young plant stage as you may pull out the young plant as well. **Pest & Disease control:** For prevention, use organic methods like EM 5 and Neem every week. If this does not work well, use chemical control measures as a last option (see photos below)	2 Liter/plant of water is irrigated every second day. Drip irrigation is the best option for irrigating because the exact amount of water is distributed evenly.
3 weeks after transplanting	**Crop care:** Make a slope (should not break down the bed) so the vine can easily grow and run on the ground. Spread the dried branches or dried straw on the ground. **Foliar fertilizer application:** Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water. At 21 days after transplanting, apply bitter salt at the rate of 12 viss per ac in a 2" deep trench between 2 planting rows on the bed.	Make sure that 3 Lit/plant of water is irrigated every second day
4-5 weeks after transplanting	**Weeding** as required. **Supplementary fertilizer:** At 30 days after transplanting, apply 9-25-25 at the rate of 45 viss per ac in a 2" x 2" trench between 2 planting rows on the bed.	Make sure that 3 Lit/plant of water is irrigated every second day.

	For the beds mulched with plastic, apply fertilizer in a hole in the plastic between 2 plants along the planting row. **Fertigation:** If farmers use fertigation, apply to plants systematically by dissolving the fertilizers in the irrigation system.	Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Avoid overflowing the trench and washing the fertilizer away.
6 - 7 weeks	**Weeding** as required. **Supplementary fertilizer:** Apply 45 viss per ac of Calcium Nitrate in a 2" x 2" the trench between the planting rows on the beds. Foliar fertilizer application – Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water (1 viss per acre). **Plant care:** For the small fruit varieties, get 3 fruit per plant. Get 2 fruits per plant for medium fruit size varieties. select the fruit from 13th leaf and onward. Get 1 fruit per plant for large fruit size varieties. Fruit should be selected from 14th-18th leaf. Select egg-size fruit and remove the mis-shaped fruit. After selecting the fruits, Make sure that the small fruits do not expose the ground. Cover the fruit with dried grass/straw to protect from sun-burn spots. Rotate the fruit regularly.	Make sure that 3 Lit/plant of water is irrigated every second day. Water requirement get higher as the plants grow. Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Irrigate just enough without overflowing the trench. Do not over water.
8 weeks after transplanting	**Weeding: A**s required. **Supplementary fertilizer:** Apply 45 viss of 9-25-25 compound fertilizer per ac in a 2' deep trench between 2 planting rows on the bed.	Make sure that 4-6 Liters/plant of water is irrigated every second day. Water requirements get higher as the plant grows. Irrigate immediately after fertilizer application in the trench between 2 planting rows on the bed. Irrigate just enough without overflowing the trench.
9 weeks after transplanting	**Foliar fertilizer application**: Spray Potassium Nitrate on the leaves in the morning at the rate of 20 tical/ 4 gal of water (1 viss/acre).	Make sure that 2 Lit/plant of water is irrigated every second day.

Chemical & Organic Options:

Symptom	Control measure
• Watermelon plant suddenly wilts Photo (1) • White powder on the leave surface Photo (2) • Aphid infestation Photo (3) • Downey disease on leave	• Use resistant varieties and practice crop rotation • Spray Difenoconazole • Spray Sulphur or Imidachlorprid 70 WP • Spray Dimethomorph or Synergy containing Mancozeb and Cymoxanil

(1) Fusarian wilt

(2) Powdery mildew

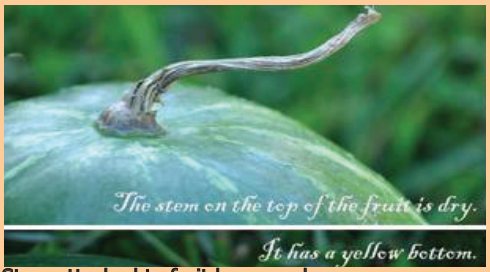
(3) Aphid infestation

(4) Downey mildew

-

Harvesting: Harvest 30-35 days after pollination when the stem attached to fruit becomes dry, skin hardens, and the fruit gives a deep hollow sound if you give it a thump.

Quality: Follow the guidelines I the pictures below for better quality.



Stem attached to fruit become dry

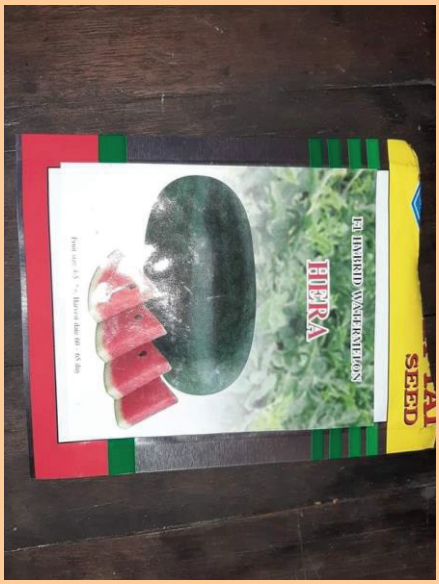
Skin harden

Have a deep hollow sound

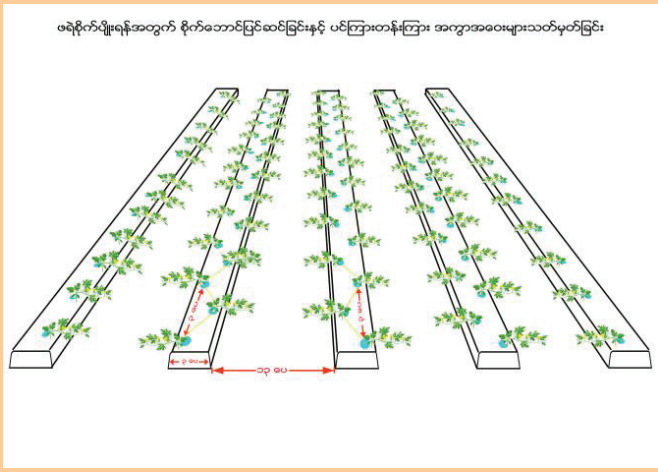
Water melon varieties

(1) 855 F1 hybrid variety produced from Known You Seed Companyr

(2) EW's Golden Sweet 80 F1 (medium size)



3. Chia Thai Company's Hera F1 variety(small size)



Bed layout

Bed layout sample of a farmer

Appendix

Soil moisture test

Soil moisture test

a. Select at random (in different rows) at least 6 points to check the soil for moisture.
b. Select a point between two plants and about 8 inches away from the line of plants.
c. Dig a hole 4 inches deep and the pick a little sample of soil between the fingers.
d. Squeeze the soil sample very hard (don't rub it).
e. Drop the sample into your other hand from about 4 inches. If the sample:
    - Blows as dust, the soil needs water immediately
    - Brakes in small pieces, it will need water in less than 4 hours
    - Doesn't break and falls in one piece, the soil has moisture for at least 24 hours

Appendix 1

Making seedling mix

Material needed in equal portions

1.	Well decomposed cow-dung	-	1 portion
2.	Rice husk charcoal	-	1 portion
3.	Top soil	-	1 portion

Making Process

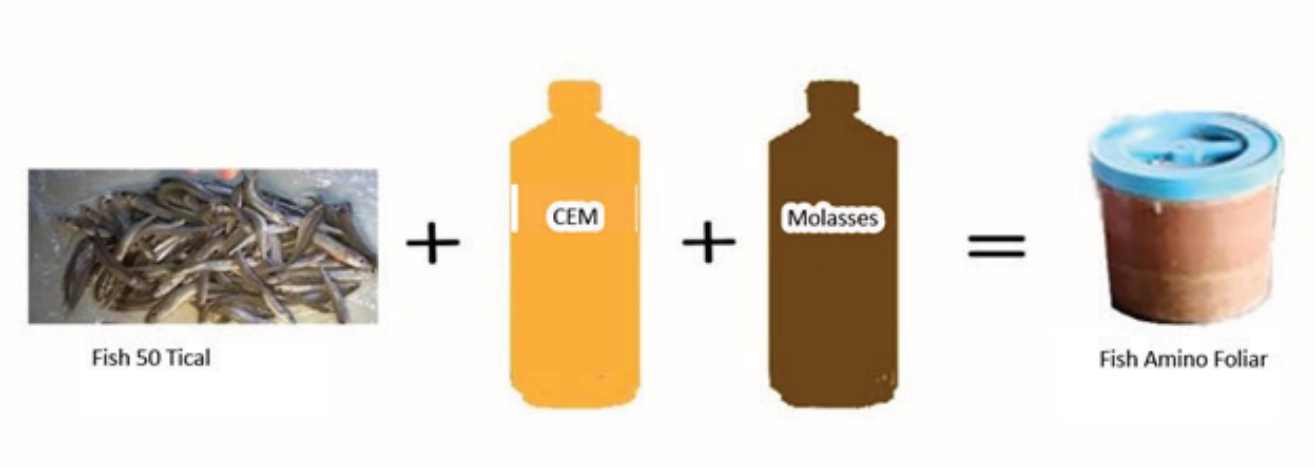
1. Mix together equal portions of well decomposed cow-dung manure, rice husk charcoal and top soil.
2. Put the mixture in a sealed plastic bag (black color) and heat up for fermentation in the sun light for 3-4 hours. The heat in the plastic bag can also kill some soil diseases.

Appendix 2

Fish Amino Foliar Making

Materials:

Fish	50 tical
CEM	1 Liter
Molasses	1 Liter



Making Process:

Boil about 50 ticals of fish in a container, stir in the water, and boil until completely tender. Small fish It is better to get fish without oil. When the fish boiling is finished, cool and add all liquid and liquid to the container. Add 1 liter of EM and one liter of molasses. Keep the air cool and keep in a cool, dry place. Every step of the procedure needs to be clean. You can start use it for 21 days.

Usage:

Fish Amino 100 CC (10 tablespoons)/4 gallon sprayer for matured plants and 50 CC (5 tablespoons)/4 gallon sprayer for small plants can be mixed. Then, can spray the plants three days interval. When sprayed more than necessary, the plant will overflow.

Benefits:

Contains the essential amino acids for crops. Root growth Good growth of plants. Good for fruit. Easily absorb from the crop. As a natural remedy, it does not harm the environment. Root sucking It can also be used in composting.

Appendix 3

How to make EM Bokashi compost

Steps in making EM Bokashi for 1/16th acre (0.06ac)

Materials needed

Rice Husk	-	2 bags
Cow Manure	-	2 bags
Rice Bran	-	1 bag
Instant EM	-	1 Liter
Molasses	-	1 Liter
Water	-	40% moisture

Procedure:

1. Find a shady flood-free site big enough for your bokashi making. You need to use at least 600 viss of compost for 1 acre.
2. Water the ground thoroughly before making the compost. Dry soil can suck the moisture out of the compost and it will not be successful.
3. Sprinkle the rice husk on the ground, then mix in the cow manure and bran.
4. Mix the EM and molasses together, pour it over the dry material and mix well.
5. Add enough water to make a ball to bring the moisture up to 40%.
6. Cover with black plastic or dark colored tarpaulin to prevent light from reaching the mixture. The micro-organisms do not like the light.
7. Bury the edges of the black plastic or tarpaulin to prevent air getting into the mixture because the micro-organisms work better without air.
8. Add some water every 10 days if the mixture is getting dry.
9. After preparation, when it has a sweet-sour fermented smell and forms white fungi filaments on the surface, it is ready to use.
10. The bokashi should be ready after 3 weeks.
11. If you do not use the bokashi immediately, you can store it in bags in a dry cool place for up to 6 months.

Appendix 4

EM 5 Repellent for general pest and disease control

Ingredients:

Concentrate Alcohol	-	100 CC
Vinegar	-	100 CC
Molasses	-	100 CC
Concentrated EM	-	100 CC
Water	-	600 CC

Preparation:

1. Put all materials in the above order in a 1 Liter bottle and seal tightly from air.
2. Keep it in a dark, dry, cool place.
3. This mixture will be ready to use as repellent after 2 weeks.
4. The ratio of application is 1:500-1:1000 (EM-5: Water).
5. Note that this is not a pesticide, but a repellent.
6. The mixture can be stored and used for up to 3 months.

Application method:

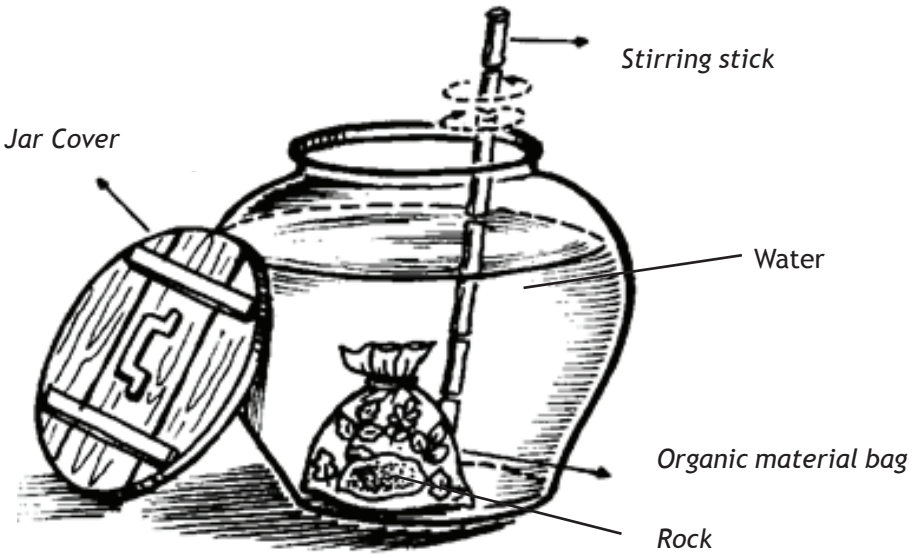
Sprayer or fine hole watering can

Appendix 5

How to make organic pesticide

Option – 1 Garden waste repellent (takes 2 months to mature)

- Put 10 pounds of organic materials (kitchen waste, cow dung, chopped up strong smelling plant material) and a heavy piece of rock in an open weave bag and put that bag at the bottom of a jar
- Pour 20 liters (or 5 gallons) of water into the jar.
- Cover the jar with a wooden lid to avoid eggs from houseflies, and bad smells
- Stir the mixture in the jar twice a day for 2 months until it does not smell so bad
- After 2 months, apply the pest disease control mixture every 4-5 days during the crop cycle. Dilute with water 1:20 for young plants and 2:20 for older plants



Option 2: EM-5 Repellent (takes 2 weeks to mature)

1.	Concentrate Alcohol	-	100 Cc
2.	Vinegar	-	100 Cc
3.	Molasses	-	100 Cc
4.	Concentrated EM	-	100 Cc
5.	Water	-	600 Cc

- Put all materials in the above order in a 1 Liter bottle and seal tightly from air.
- Keep it in dark, dry, cool place.
- Start to use as repellent after 2 weeks.
- Apply at a rate of 1:500-1:1000 (EM-5: Water).
- Note: This is not pesticide, only repellent.
- It can be used for up to 3 months.

Appendix 6

Making natural pesticide to prevent sucking insects

Special Note: Must be used within a day.

Ingredients:

Green chili	10 Tickles
Garlic	10 Tickles
Ginger	15 Tickles
Basic Soap	10 Tickles
Mustard Oil	5 Spoons
Water	5 Gallons

Preparation:

1. Pound the garlic and keep it in the mustard only one night.
2. Next day add pounded ginger + green chili and mix all together.
3. Put all ingredients in the water and stir it.

Application:

Apply using a knap sack sprayer. Filter and remove particles before spraying.

Appendix 7

Solution for powdery mildew and downy mildew:

Ingredients:

Copper Sulphate	-	28 tickles
Lime	-	28 tickles
Water	-	10 gallons

Preparation

- Add copper sulphate (28 tickles) to water (5 gallons) and stir thoroughly in plastic bucket A.
- Add lime (28 tickles) to water (5 gallons) and stir thoroughly in plastic bucket B.
- Then mix the two solutions in a third larger bucket and stir.
- Sieve the solution in a strainer so larger particles can't pass through. Always stir thoroughly before spraying.
- This mixture can be used within 24 hours.

Note -Use a bamboo or plastic stick. Do not use iron, zinc or metal buckets because the copper will corrode them.

Appendix 8

RAKHINE WINTER
CROPS PROJECT

NEW ZEALAND
FOREIGN AFFAIRS & TRADE
Aid Programme