TECHNICAL OPERATIONAL MANUAL

TOMATO

AGRICULTURAL SECTOR MODERNIZATION PROJECT (ASMP)

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INTRODUCTION

Origin

Tomatoes originated in western South America, specifically in the region that includes present-day Peru, Ecuador, and northern Chile. The wild ancestors of modern tomatoes are believed to have been small, cherry-sized fruits that grew in these areas.

The cultivation of tomatoes began with indigenous peoples in Central America and Mexico. By the time Spanish explorers arrived in the 16th century, tomatoes were being grown and consumed in these regions. The Spanish brought tomatoes back to Europe, where they were initially met with skepticism and were sometimes thought to be poisonous. Over time, however, tomatoes became a staple in various European cuisines, particularly in Italy and Spain, leading to their widespread cultivation and consumption around the world.

Economic Importance

Tomatoes hold significant global economic importance for several reasons:

1. Agricultural Output: Tomatoes are one of the most widely cultivated and consumed vegetables worldwide. They rank among the top vegetable crops, contributing substantially to agricultural GDP in many countries.
2. Trade: Tomatoes are a major agricultural commodity in international trade. Countries like Mexico, the United States, and Italy are leading exporters, while others import large quantities to meet domestic demand. This trade helps support economies and creates jobs in both exporting and importing countries.
3. Diverse Uses: Tomatoes are versatile and used in various forms—fresh, canned, dried, and processed into sauces, juices, and more. This diversity opens multiple markets, increasing their economic value.
4. Employment: The tomato industry supports millions of jobs globally, from farming and harvesting to processing and distribution. It plays a vital role in rural economies, providing livelihoods to farmers and workers.
5. Nutritional Value: Tomatoes are rich in nutrients, making them a staple in many diets. Their health benefits contribute to their demand, supporting the food industry and influencing agricultural policies.
6. Sustainability and Innovation: The tomato sector is increasingly focused on sustainable practices and innovations, such as hydroponics and genetically modified varieties. These advancements aim to improve yield and reduce environmental impact, ensuring long-term economic viability.
7. Cultural Significance: Tomatoes hold cultural importance in various cuisines, enhancing their marketability and driving demand in diverse regions, which further stimulates economic activity.

Tomatoes are not just a staple food; they are a crucial component of the global economy, influencing trade, agriculture, and nutrition worldwide.

Optimal Ecological Requirements

Tomatoes thrive in specific agro-ecological conditions that ensure optimal growth and yield. Here are the key factors to consider:

1. Climate:
    a. Temperature: Tomatoes prefer warm temperatures, ideally between 20°C to 30°C (68°F to 86°F). Night temperatures should not drop below 10°C (50°F).
    b. Light: Full sun exposure (at least 6-8 hours of direct sunlight daily) is crucial for healthy growth and fruit development.
    c. Humidity: Moderate humidity levels are preferred, as excessive moisture can lead to diseases such as blight.
2. Soil:
    a. Type: Well-drained, loamy or sandy soils are ideal. Heavy clay soils can hinder root development and drainage.
    b. pH Level: A slightly acidic to neutral pH (6.0 to 7.0) is optimal for nutrient availability.
    c. Nutrient Content: Rich organic matter enhances soil fertility. Tomatoes benefit from adequate levels of nitrogen, phosphorus, and potassium.
3. Water:
    a. Irrigation: Consistent moisture is essential, especially during flowering and fruiting stages. Drip irrigation is often recommended to minimize water stress and prevent foliar diseases.
    b. Drainage: Good drainage prevents waterlogging, which can lead to root rot.
4. Pests and Diseases:
    a. Understanding the local pest and disease pressures is important for management strategies. Crop rotation and resistant varieties can mitigate these issues.
5. Altitude:
    a. Tomatoes can be grown at various altitudes, but certain regions may have specific advantages or challenges based on temperature and growing season length.

6. Growing Season:
    a. A frost-free growing season is crucial for tomato cultivation, with the length varying by region. Tomatoes are typically planted after the last frost date.

By providing these ideal conditions, farmers can enhance tomato growth, leading to healthier plants and higher yields.

LAND PREPARATION AND DRAINAGE

Primary Land Preparation

1. Deep ploughing using a disk or mouldboard plough as large as possible, from 30 cm to 60 cm (12” to 24”) in diameter.
2. Incorporation organic matter, commercial compost (12 MT per hectare or 5 MT per acre) and other soil amendments as required by broadcasting all over the plot surface.
3. Deep plough again perpendicular to the first pass.

Secondary Land Preparation

1. Heavy Soil Textures
    a. Disk harrow using a disk harrow implement with disks having a diameter from 18 cm to 24 cm (7” to 10”).
    b. Two passes perpendicular to each other are required.
2. Light Soil Textures
    a. Cultivate using a tine tiller implement.
    b. Two passes may be required in sandy clay loam soils.

Tractor

1. A tractor size 75 to 99 HP (75 to 85 POT), four-wheel drive, is best to pull large ploughing equipment.

Drainage

Drainage is of particular importance for the Tomato as the crop is susceptible to several root diseases. Good internal drainage provided by raised beds (30 cm to 50 cm high) and a network of drainage ditches to quickly evacuate high amounts of rainfall are very important practices to prevent Fusarium Wilt, Phytophthora root rot and other soil borne diseases affecting Tomato.

Evacuation Drainage

For small plots, a "U" type drainage design is recommended. This system is made up of two lateral drainage ditches (collectors) at the extreme ends of the plot that drain into a primary drainage canal (evacuator) that evacuates the water away from the plot into a safe area, avoiding damage to property or goods. All drainage ditches must be trapezoidal in shape to avoid the collapse of the walls into the ditch and subsequent loss of depth by sedimentation. Grass or small plants can be promoted on the walls of the ditches to keep them stable. The size of the laterals and evacuator should be as shown below:

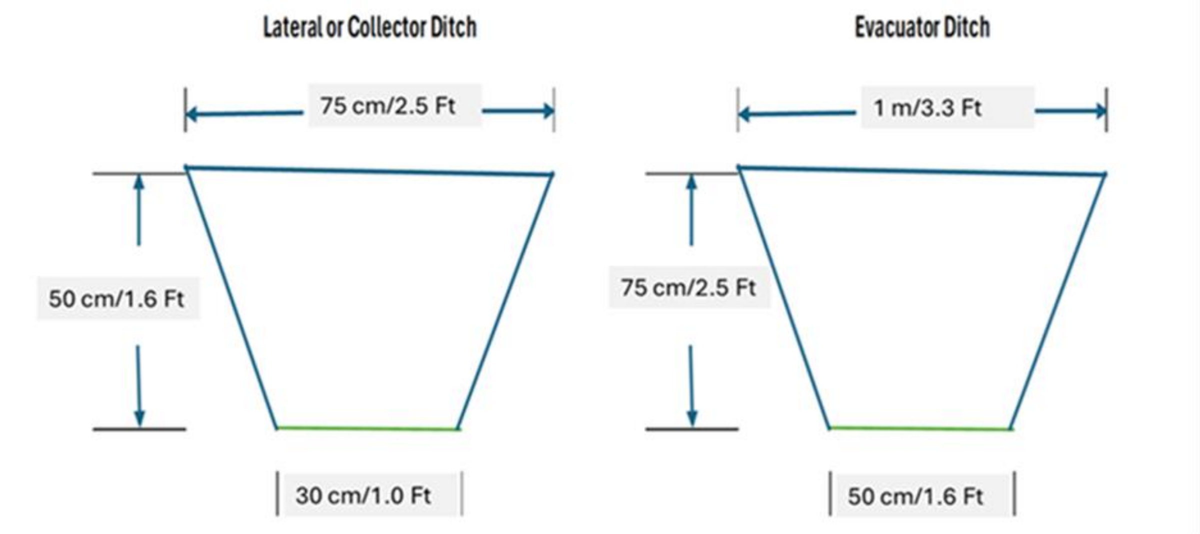


Figure 1: Size of Drainage Ditches

All ditches must have a slope or gradient of at least 0.1% which is equivalent to a drop of 1 m in 1,000 m. This slope is also expressed as 0.001

This on-farm simple drainage system can evacuate 4 mm of rain per hour or 96 mm per day. Catastrophic conditions such as flooding can occur with rainfall greater than 100 mm per day. These conditions will cause damage to crops and can only be mitigated with macro drainage work done by the Government.

Before making the ditches, it is necessary to observe the slope of the plot. It is recommended to place the large evacuator ditch cutting across the terrain and along the lowest section of the plot. Then, the lateral ditches are placed perpendicular to the evacuator. The planting beds should drain into the laterals or collectors, which, in turn, drain into the large evacuator

If necessary, for crops that are planted in the East-West direction such as the double row planting of fruit trees, the laterals can be made to cut across the double rows to force them to drain into the large evacuator placed along the lowest section of the plot.

Surface Drainage

After a heavy rain, wet spots often remain in different locations, especially if the field has not been levelled or does not have a slope gradient sufficient to force the water out of the plot by gravity. In these cases, it is recommended for the farmers to drain all the wet spots by manually guiding the water out of each spot into a nearby drainage ditch or canal using a hoe type tool. Two or more wet spots can be connected to be finally drained into a drainage ditch or canal.

Figure 2: Draining Wet Spots Using Surface Drainage

VARIETIES

The Padma variety of tomatoes is the recommended variety to plant in Sri Lanka by the ASMP. It is a popular cultivar known for its high yield and adaptability to local growing conditions. It typically features medium to large-sized fruits that are round to slightly oblong in shape. The skin is smooth and has a bright red color when ripe, making it visually appealing.

Padma tomatoes are appreciated for their excellent taste, with a balance of sweetness and acidity, making them suitable for a variety of culinary applications, including salads, sauces, and curries. The variety is also known for its resistance to common tomato diseases, which helps reduce the need for chemical treatments.

Padma tomatoes are favored due to their ability to thrive in the country's climate and soil types, contributing to both commercial farming and home gardening. The variety is typically planted during the main growing season and can be harvested in about 70 to 80 days after planting. Overall, Padma tomatoes play an important role in both local diets and the agricultural economy of Sri Lanka.

PLANTING MATERIAL

Tomato seedlings for transplant are grown in an elevated nursery stand 0.9 m high, 0.75 m to 1 m wide and as long as required, provided there is enough space in a protected place near the farmer's house or similar for protection against animals and other and near a good water source. The nursery stand has a clear thick plastic ceiling (higher than 50 microns gauge).

Figure 4: Elevated Nursery

Feature	32mm pellet	38mm pellet	42mm pellet
Diameter (mm)	32	38	42
Initial height (mm)	6 - 7	10 - 12	13 - 15
Expansion height (mm)	26 - 34	36 - 42	40 - 45
Dry weight (g)	3 - 3.5	5.5 - 6	6.5 - 7.5
Absorbing water amount (ml)	21 - 29	38 - 40	52 - 60
Water holding capacity (%)	70 - 75	70 - 75	70 - 75
Porosity (%)	19 - 25	19 - 25	19 - 25
Wetting time (minutes)	2	2	2
Electrical conductivity	0.09 - 0.1 (S/m)	0.09 - 0.1 (S/m)	0.09 - 0.1 (S/m)
PH	5.5 - 6.5	5.5 - 6.5	5.5 - 6.5
Suitable for	Tomato, basil, coriander, flowers, pepper, small plant cuttings	cucurbits, sweet pepper, lettuces, comparatively large seeds	Ornamental plant cuttings, tissue cultural plants

Figure 3: Cocopel Specifications

Cocopel is recommended as the growing medium for seedlings because of its many advantages and labor-saving practicality. This material comes ready to support the seedlings as they grow, providing a disease-free and nutrient rich environment to produce optimum planting material to cultivate tomatoes.

Cocopel, a compressed growth pellet disk produced using high quality treated coconut coir fiber pith, originates from renewable and organic raw materials. The "Cocopel Grow Pellet" comes with added fertilizer and is wrapped around the pellet with a bottom sealed bio-degradable net. The net is certified by the EU.

Figure 5: Cocopel Disks and Growth Container

The pellets are expanded to nursery size containers by adding moisture. Then the Tomato seeds are sowed one at a time in the expanded pellet. The seedlings need to grow for at least 30 days to reach a height of 12 cm – 15 cm. They are ready for transplanting (field ready) at the specified height and have 5 to 6 well developed leaves, in addition to being free from pests and diseases.

The fertilizer content of the pellet is supplemented once per week with foliar applications of fertilizers containing micronutrients until the seedlings are field ready.

After sowing and for the growing period in the elevated nursery stand (approximately 30 days), the pellet containers are placed on plastic trays designed to support a good number of the expanded pellets.

HIGH DENSITY PLANTING

Procedure

The Tomato is planted in beds made by mechanical bed-makers pulled by tractors. They can also be made by hand. The beds should be 60 cm wide and 30 cm to 50 cm high and are separated by a trench 30 cm wide. This planting configuration makes the total distance from center to center of two adjacent beds is 90 cm.

Figure 6: Planting Pattern and Spacing

After making the beds, one drip tape line is installed in the middle of the bed for irrigation purposes. The drip tape is double layer, white in color and UV resistant (the outer layer is UV treated). Its wall is 0.30 mm thick, and the tape has a 16 mm diameter. Emitters are spaced at 30 cm on the tape and the flow rate for the emitters is 2 Lt/Hr at 1.5 Bar to 2.0 Bar of pressure. The drip tape is followed by a silver and black plastic mulch with a thickness (gauge) of 30 microns to 40 microns and a width of 5 ft (1.52 meters). The mulch is placed on top of the planting beds.

Two rows of plants are placed on every bed. The distance between the two rows is approximately 40 cm to 45 cm. The planting distance inside the planting rows of 40 cm is then marked on the mulch with a planting guide or template that uses sharp nails to make the planting marks. The planting pattern for the two rows of the crop on every bed should be triangular to minimize the high-density effect on plant-to-plant competition. This planting pattern is always preferred for high density planting.

Figure 7: Planting Beds and Drip Tape

Plastic mulch, combined with drip tape irrigation, high planting beds and high-density planting is considered the current "state of the art" technology for high value crop production. This combination is one of the most efficient and productive systems for maximizing both yield and irrigation efficiency.

The mulch is then perforated by using very hot iron or aluminum cylinders such as discarded processed food aluminum cans. The metal cylinders are kept red hot with burning charcoal.

For planting purposes, all distances are carefully measured and staked out in the field with construction twine in order to achieve the desired population density as precisely as possible.

Plant Spacings Within the Crop Rows

Tomato	0.40 m
Population Density per Half Acre	11,311

Planting Aids

1. Construction twine (preferably white coloured)
2. A good number of wooden stakes to layout base lines and crop rows
3. Previously made planting templates
4. Measuring tape
5. Markers

IRRIGATION AND FERTIGATION

Irrigation

The average consumptive use of water by tomatoes typically ranges from about 4 to 7 mm/day, depending on various factors such as climate, growth stage, and soil type. During peak growth periods, it can be on the higher end of that range. Proper irrigation management is essential to maintain optimal growth and yield.

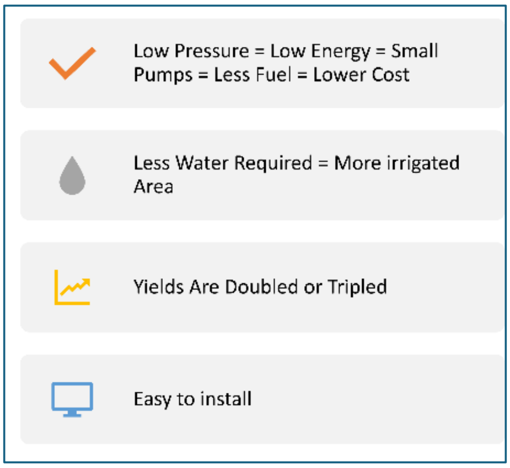


Figure 8: Advantages of Low-Pressure Irrigation

Low pressure irrigation is the best method of applying uniform and precise amounts of water directly to the root zone of the plants, as per their above requirement, through emitters at frequent intervals over a period, via a pipe network comprising of mains, submains, and laterals. In this system, water is applied drop by drop or by micro jet (micro sprinkler), on the soil surface or below it (sub-surface), at a rate lower than the infiltration of the soil.

Figure 9: Drip Tape for Irrigation

New Irrigation Concepts

- Net Area Irrigation – Water for Cultivated Area Only
- Evapotranspiration for irrigation scheduling rather than soil moisture content.
- Consumptive Water Use by Crops: Different Crops Different Amounts of Water
- Water Amounts Are Adjusted to The Physiological Development of the Crops (Kc Constants per Crop)

Water Requirements

The water requirements of Tomato (bell pepper) can vary significantly at different stages of phenological development:

1. Germination and Seedling Stage (0-3 weeks) :
   a. Water Requirement: Approximately 2-4 mm/day.
   b. During this stage, consistent moisture is essential for seed germination and early root development.
2. Vegetative Stage (3-6 weeks) :
   a. Water Requirement: Approximately 4-6 mm/day.
   b. As the plants grow larger, their water needs increase to support leaf and stem development.
3. Flowering Stage (6-9 weeks) :
   a. Water Requirement: Approximately 6-8 mm/day.
   b. Adequate moisture is crucial during flowering to prevent blossom drop and ensure fruit set.
4. Fruit Set and Development Stage (9-12 weeks) :
   a. Water Requirement: Approximately 6-10 mm/day.
   b. This stage has the highest water requirement as the fruits develop and ripen. Stress during this period can lead to issues like blossom end rot.

5. Maturity and Harvest Stage (12 weeks and beyond) :
   a. Water Requirement: Approximately 4-6 mm/day.
   b. As the fruits reach maturity, their water needs decrease slightly, but consistent watering is still important to maintain fruit quality.

These values can vary based on environmental conditions, soil type, and specific tomato varieties. Regular monitoring of the Field Capacity of the soil moisture and adjusting irrigation according to the daily evapotranspiration loss is important for optimal growth and yield.

Water Application

Figure 10: Mini Weather Station

Low pressure irrigation systems are designed to keep the soil moisture level at Field Capacity which is the optimal soil moisture level for root growth and development. At this level, the soil provides ample and sufficient amounts of Oxygen and water to the roots of the different crops.

At constant field capacity soil moisture, the amount of water to be applied through irrigation is the water loss by evapotranspiration, adjusted for rainfall. In other words, low pressure irrigation must provide the amount of water necessary to cover the water deficit of the crop on a daily basis to prevent the crop from suffering from water stress and losing yield potential. Modern weather stations provide evapotranspiration rates on a daily basis for farmers to properly irrigate their crops. To facilitate this modern technology process, ASMP has installed mini weather stations in 21 Clusters in different Districts of the Country.

In the absence of weather station data, the amount of water to be applied is based on the consumptive water use of the crop. As a minimum, and on a daily basis, crops must receive the amount of water required for optimum growth, development and yield, defined as consumptive water use. Tomato consumptive water use is defined as 6 mm/Day in this manual for calculation purposes.

Based on this concept, the water use amount by the plant is adjusted further using the FAO Kc factors or crop irrigation coefficients that consider the phenological development of the Tomato plant, including canopy and root development,

	initial	Development	Production
Kc Factor FAO	0.5	1.2	1

This daily amount can be accumulated on a weekly basis and applied in two cycles of irrigation per week. As an illustration, the chart below shows the recommended irrigation times per cycle to deliver the weekly adjusted consumptive water use of Tomato using the drip tape irrigation system.

Table 1: Irrigation Time for Tomato Based on Consumptive Water Use

Irrigation Schedule	**initial**		**Development**		**Production**	
Irrigation Time (Hours/Minutes)	0	48	1	40	1	25

However, it is important to note that crops may need more water than the consumptive water use on a daily basis to prevent water stress and loss of yield potential brought about by water deficits that are determined by evapotranspiration, rainfall, etc. On a practical basis, and for the sake of simplicity, more water should be applied on very hot and dry days and less on cloudy and rainy days, and the weather stations can tell us exactly how much to apply.

Fertigation

Nutritional Requirements

To achieve maximum yield for tomatoes, it's essential to provide the right nutrients through fertilization:

1. Soil Testing: Before applying fertilizers, conduct a soil test to determine existing nutrient levels and pH. Tomatoes thrive in slightly acidic to neutral soil (pH 6.0 to 7.0).

2. N-P-K Ratio: Look for fertilizers with a balanced N-P-K (Nitrogen-Phosphorus-Potassium) ratio, such as 5-10-10 or 8-32-16. Nitrogen promotes leafy growth, phosphorus supports root and flower development, and potassium enhances fruit quality and disease resistance.

3. Nitrogen Needs: Apply nitrogen-rich fertilizers early in the growing season to promote vigorous plant growth. However, avoid excessive nitrogen as it can lead to lush foliage with fewer fruits.

4. Phosphorus for Root Development: Phosphorus is crucial during the early stages and flowering. Use fertilizers high in phosphorus at planting time to encourage strong root systems and blooming.

5. Potassium for Fruit Quality: Potassium is vital throughout the growing season, especially during fruit development. It improves flavor, color, and overall fruit quality.

6. Micronutrients: Tomatoes also require micronutrients like calcium (to prevent blossom end rot), magnesium, and sulfur. Consider using lime or gypsum to supply calcium and magnesium, and a complete fertilizer that includes these micronutrients.

7. Monitoring: Regularly observe your plants for signs of nutrient deficiencies (such as yellowing leaves or poor fruit set) and adjust your fertilization accordingly.

Fertigation Recommendations

For the Tomato in the Vegetables Cluster in Badulla, fertilizer application is based on soil test results (Annex 2). Soil test results are interpreted using critical levels of nutrients and several other chemical and physiological considerations to develop a complete fertilizer recommendation.

Table 2: Interpretation of the Soil Test

Low Mg in two sites
Low K in two sites
Low S in 4 sites
Cu, Mn and Zn generally low
Narrow Cation Ratios
Low Ca Saturation

The results for the soil test for Tomatoes in the Vegetable Cluster in Badulla indicated the following:

Therefore, the recommendations for the application of fertilizers for this soil test are as

Table 3: Fertilizer Recommendations Bases on the Soil Test

Urea as required by the crop
$CaCO_3$ lime at land preparation
MOP in two sites
$MgSO_4$
Foliar Micronutrients as T-Flush

follows:

Based on the above considerations, the recommended amounts of nutrients to be applied through fertigation in the sites with low Potassium are shown in elemental and oxide form below:

Recommendation	N	K	Mg
Kg/Ha	150.0	150.0	50.0
Lb/acre	150.0	150.0	50.0
Kg/Acre	68.2	68.2	22.7

Phosphoric Acid P (Kg/Ha)	20.0

Recommendation	Urea	K20	MgO
Kg/Ha	326.1	343.7	82.9
Lb/acre	326.1	343.7	82.9
Kg/Acre	148.2	156.2	37.7

The Phosphoric Acid is recommended to prevent the physical and chemical clogging of the irrigation system.

The elemental quantities of nutrients need to be converted to fertilizer materials to make up the fertigation recommendation for the whole cropping season in Kg/Acre:

Kg/Acre	Urea	MOP	P Acid	MgSO4
Fertilizer per Season	322	260	33	227

Each of these amounts of fertilizer materials is then adjusted according to the phenological development of the crop. The FAO Irrigation Crop Coefficients (Kc) for Tomato are used for this purpose:

Parameter	Initial	Development	Production
Kc	0.50	1.2	1.0

This means the crop will receive 50% of the recommended amounts of fertilizer during the initial stages of physiological development, 120% during the development or active growth phase and 110% during the production phase.

These amounts of fertilizers are then distributed on a per week basis according to the duration of each phenological stage of the crop cycle. These calculations result in amounts of fertilizer materials per Acre and per week (Kg/acre/Week):

Crop Cycle	Initial	Development	Production
Weeks	4	9	4

Kg/Acre/Week	Initial	Development	Production
Urea	37.59	45.11	75.18
MOP	30.37	36.45	60.75
MgSO4	26.52	31.82	53.03
P Acid	3.81	4.58	7.63

The weekly amounts of fertilizers are then converted to amounts per application using 2 applications per week:

Kg/Acre/Application	Initial	Development	Production
Urea	18.796	22.555	37.592
MOP	15.187	18.224	30.373

MgSO4	13.258	15.909	26.515
P Acid	1.907	2.288	3.813

Finally, the amounts per Acre per application are adjusted to the size of the net production area of the plot which for the ASMP Project is half an Acre (50 m x 40 m):

Bed Width (m)	Bed Length (m)	Bed Net Area (m2)	Number of Beds	Plot Net Area (Acres)
0.6	40	24	56.6	0.34

In other words, in a production area of 0.5 Acre, only 0.34 Acres will be receiving fertilizer as follows:

Plot/Application	Unit	Initial	Development	Production
Urea	Kg	6.38	7.65	12.76
MOP	Kg	5.15	6.18	10.31
MgSO4	Kg	4.50	5.40	9.00

The fertigation recommendation is complemented by the recommended application of other required fertilizer materials as indicated below:

Apply Calcium in the form of CaCO3 at a rate of 200 Kg/Half Acre during land preparation
Foliar Applications of Micronutrients (T-Flush 100 ml/16 L) Are also Recommended weekly. Very important

WEED CONTROL

Weeds are controlled using agricultural type silver and black plastic with a thickness (gauge) of 30 microns to 40 microns and a width of 5 ft (1.52 meters). Agricultural plastic mulch offers several distinct advantages in agricultural applications:

- One of its primary benefits is weed suppression, as the opaque nature of the mulch effectively blocks sunlight, preventing weed growth and reducing the need for chemical herbicides.
- Additionally, plastic mulch helps to conserve soil moisture by minimizing evaporation, thus supporting more efficient water use and reducing the frequency of irrigation.
- The mulch also serves to warm the soil, promoting earlier planting and enhancing overall crop development, particularly in cooler climates.
- Furthermore, the use of plastic mulch can lead to improved fruit and vegetable quality by preventing direct contact with the soil, reducing the risk of rot and spoilage.

Overall, plastic mulch contributes to increased crop yields, improved crop quality, and more efficient use of resources, making it a valuable tool in modern agricultural practices. Nevertheless, while plastic mulch offers several benefits in agriculture, including weed suppression, soil moisture retention, and increased soil temperature, it also presents several notable management challenges:

- The prolonged use of plastic mulch using non-biodegradable materials can lead to pollution and soil contamination when left in the field for a long time after the cropping season.
- Unproper disposal of plastic mulch can result in visual pollution in agricultural areas and contribute to long-term soil degradation.
- The use of plastic mulch as a continuous field practice, crop after crop, can impede natural soil aeration and microbial activity, potentially disrupting the soil ecosystem, and causing the accumulation of plastic residues in the soil.
- The cost of purchasing and removing plastic mulch, as well as the labor involved in installation and disposal, can be significant but are alleviated by the financial returns from the higher yields and better quality obtained with plastic mulch, particularly for small farmers.
- The use of plastic mulch must be accompanied by drip tape irrigation and high planting beds to avoid excess water runoff that causes the loss of nutrients that can lead to environmental contamination, impacting surrounding water sources.
- The accumulation of water on the surface of the plastic mulch from rainfall and/or irrigation must be prevented to avoid the possibility of waterlogging in some instances.
- The physical barrier between the soil and the atmosphere caused by plastic mulch can interfere with the natural nutrient cycling processes, potentially leading to imbalances in soil nutrient levels and impacting long-term soil fertility when fertigation is not practiced using the drip tape irrigation system.

If there is a need to control weeds by other means, only mechanical weed control practices are to be used. Herbicides are not allowed for social and environmental reasons. The most common mechanical weed control practices are:

1. Cultivation with a tractor using a rotavator implement.
2. Motorized weed cutters that use plastic cords to cut weeds (weed eaters)
3. Workers use bush knives or any other cutting or chopping tool.

PEST AND DISEASE MANAGEMENT

IPM concepts and practices must be applied to manage Tomato pests and diseases. The Quantity/Intensity factor is a practical and easy to apply IMP concept in deciding whether to apply pesticides:

Quantity	Coverage
Intensity	Severity

	Quantity		
Intensity	**Low**	**Medium**	**High**
Low	Observation	Observation	Localized
Medium	Spot Treatment	Localized	Full Treatment
High	Localized Treatment	Full Treatment	Full Treatment

Peripheral Insect Net

Figure 11: Peripheral Insect Net

The use of insect nets represents a highly effective and environmentally friendly method for protecting crops from insect pests as part of an IPM approach. By strategically protecting crop fields with peripheral fine-mesh insect nets, farmers can create a physical barrier that prevents harmful insects from reaching the plants, thereby reducing the need for chemical pesticides. These nets serve as a protective shield, effectively blocking the entry of a wide range of pests, including aphids, thrips, whiteflies, and caterpillars, while also providing a barrier against certain diseases carried by insects. Furthermore, insect nets allow for the passage of air, light, and water, ensuring that crops receive the necessary resources for healthy growth. With the ability to significantly reduce pest damage and minimize the risk of crop losses, the use of insect nets demonstrates a sustainable and integrated approach to crop protection, contributing to both higher yields and the promotion of eco-friendly agricultural practices.

Designing an acre-sized peripheral insect net for Tomato plants would require careful planning and a significant number of materials. Here's a conceptual design for an acre-sized peripheral insect net, along with estimated quantities of materials required:

Design

1. Support Structure:	• 8-foot wooden or metal poles placed every 15 feet along the perimeter of the acre. • Galvanized wire or strong twine to connect the poles at the top to form a framework for the net.
2. Netting:	• High-quality, fine mesh netting that is durable and provides ample protection against insects and pests. • The netting should be large enough to cover the entire acre, with some extra for securing it to the ground.

3. Anchoring System:	• Ground stakes or sandbags to secure the netting to the ground and prevent it from being blown away by wind.
4. Access Points:	• Zippers or flaps within the netting to allow entry and exit for workers and equipment.

Materials Required (estimated for an acre):

1. Support Structure:	• Wooden or metal poles: 80 poles (assuming poles are placed every 15 feet). • Galvanized wire or strong twine: Approximately 3,000 feet.
2. Netting:	• High-quality, fine (40 mesh to 60 mesh) mesh netting: Approximately 2 acres of netting to allow for overlap and secure attachment.
3. Anchoring System:	• Ground stakes or sandbags: Approximately 200 stakes or sandbags.
4. Access Points:	• Zippers or flaps: 6-8 heavy-duty zippers for access points.

These quantities are estimates and may vary based on the specific design, quality of materials, and other factors. It's important to consult with a professional or supplier to determine the exact requirements for your specific project.

Insecticides are often sprayed on insect nets to enhance the effectiveness of pest control measures. Insect nets serve as a physical barrier to prevent insects from reaching crops or protected areas, but their efficacy can be further heightened by treating them with insecticides. This dual approach provides a comprehensive solution by combining the mechanical barrier of the net with the chemical action of the insecticide. The insecticide helps to repel, deter, or kill insects that come in contact with the net, offering an added layer of defense against pests. This integrated approach not only safeguards crop more comprehensively but also contributes to sustainable pest management practices, reducing the reliance on excessive chemical applications on the surrounding environment. It ensures a more targeted and efficient use of insecticides, promoting a balanced and environmentally conscious approach to crop protection.

Usually, Abamactine at 26 ml per 16 L knapsack spray tank is used for mites and Imidachlorophid for thrips at 20 ml per 16 L knapsack spray tank every 10 days, alternating the products. During the dry season, the application intervals could be increased to 2 weeks if pest activity is low.

Yellow Sticky Traps

Figure 12: Yellow Sticky Traps

Yellow sticky traps play a crucial role in integrated pest management strategies for field crops, offering farmers a valuable tool for monitoring and controlling insect populations. By strategically placing these traps throughout crop fields, farmers can effectively monitor insect populations and identify potential threats to the crops. The bright yellow color of the traps acts as a powerful attractant for a wide variety of flying insects, including aphids, thrips, leafhoppers, and other pests known to damage field crops. Once captured on the adhesive surface of the traps, these insects are effectively removed from the crop environment, helping to mitigate potential yield losses and reduce the need for chemical insecticides. By incorporating sticky yellow traps into their pest management plans, farmers can contribute to the sustainable and environmentally conscious cultivation of field crops, promoting healthier yields and minimizing the impact of harmful pests on agricultural production.

Sticky yellow traps are typically coated with a bright yellow, non-drying adhesive that attracts a wide range of flying insects. Once insects come into contact with the sticky surface, they become firmly trapped, preventing them from causing further damage to plants. The yellow color of the traps is particularly attractive to many types of insects, making them a popular choice for both professional growers and home gardeners.

Figure 13: Yellow Sticky Traps in the Field

Environmentally friendly and easy to use, sticky yellow traps serve as a valuable tool in integrated pest management strategies, helping to maintain healthy plant growth without the need for harmful chemical pesticides.

For Tomato, sticky yellow traps are placed at 10 m intervals along the edge of the planting beds, alternating the side of the bed they are placed on. This arrangement creates a network of protection against harmful insects, especially those involved in the “Curled Leaf Virus Complex”.

Aflatoxin Contamination

Aflatoxins are a family of naturally occurring mycotoxins produced by fungi in the genus Aspergillus. These fungi live naturally in soil, as well as in dead and decaying plant material in fields. Aflatoxins are highly carcinogenic and mutagenic, having the ability to cause liver cancer, damage the immune system and decrease growth and productivity in both humans and livestock. These toxins are found all over the world. In hot and humid agricultural regions there can be a serious loss to the value of crops from aflatoxin contamination.

Aflatoxins are regularly found in improperly stored staple commodities such as Tomato, peppers, cassava, maize, cotton seed, millet, peanuts, rice, sesame seed, sorghum, sunflower seed, tree nuts, wheat, and a variety of spices. When contaminated food is processed, aflatoxins enter the general food supply where they contaminate both human and livestock foods. Animals fed contaminated food can pass aflatoxin transformation products into eggs, milk products, and meat.

Most strains of *Aspergillus parasiticus* can produce the group of four mycotoxins: B1, B2, G1, and G2, while *Aspergillus flavus* usually only produces B1 and B2. Aflatoxin occurs due to the colonization and contamination by the fungus. This can occur in crop plants in the field, at harvest, during post-harvest activities or in storage. The fungus *Aspergillus flavus* is green in color, but aflatoxin contamination is not always visible. Aflatoxin contamination can be determined through laboratory tests. The degree of aflatoxin contamination depends on temperature, humidity, and storage conditions. The most effective way to control aflatoxin contamination in susceptible crops is controlling the growth of the causative fungi. Traditionally, this can be achieved by adopting GAPs, and good harvesting, drying and storage practices. Pest management is also important since insects and diseases expose susceptible plant tissues to colonization of the fungi.

Farmers and processors selling aflatoxin contaminated products are generally penalized with a much lower price than those selling uncontaminated goods. In developed countries where phyto-sanitary standards are strictly implemented, consignments with harmful levels are rejected and at times the suppliers are blacklisted or fined. Different countries have established limits for the aflatoxin contamination on the products which they import. For example, the European Union allows no more than 10 parts per billion (ppb) of all aflatoxins, except B1 which has a maximum limit of 5 ppb. The US has a maximum allowable limit of 20 ppb of all aflatoxins, combined.

Most Common Pests in Sri Lanka

In Sri Lanka, Tomato is susceptible to several common pests, which can significantly impact yield and quality:

Pest	Description	Damage	Management
Tomato Fruit Borer	A caterpillar that burrows into the fruit.	Holes in fruit, leading to decay and loss.	Use insecticides, handpick larvae, and crop rotation.
Whiteflies	Small, white, winged insects that feed on plant sap.	Yellowing of leaves, stunted growth.	Use insecticidal soaps, introduce natural predators, and remove infested plants.
Aphids	Small, soft-bodied insects that cluster on new growth.	Curling leaves, reduced vigor, and sooty mold.	Apply neem oil, introduce ladybugs, and maintain plant health.
Spider Mites	Tiny arachnids that create fine webbing on plants.	Speckled leaves, reduced photosynthesis.	Use miticides, increase humidity, and regularly wash plants.
Thrips	Tiny, slender insects that feed on leaves and flowers.	Silvering of leaves and distortion of flowers.	Use insecticides, introduce predatory insects, and practice good sanitation.
Cutworms	Caterpillars that cut seedlings at the base.	Seedling loss and damage to young plants.	Use collars around seedlings, handpick, and apply insecticides.

Figure 14: White Fly

Figure 15: Thrips Damage

Figure 16: Aphids on Leaf

Figure 17: Mites Damage

Integrated pest management strategies, including cultural practices, biological controls, and targeted chemical applications, are essential for effectively managing these pests in Tomato cultivation in Sri Lanka. Regular monitoring or vigilance and timely interventions by the farmers can help minimize pest damage and improve crop health.

When chemical control is practiced, only pesticides that are registered in Sri Lanka should be used at DOA recommended amounts.

Most Common Diseases in Sri Lanka

In Sri Lanka, Tomato is susceptible to several common diseases, which can significantly impact yield and quality:

Disease	**Description**	**Damage**	**Management**
Tomato Blight	Caused by the fungus *Phytophthora infestans*.	Dark, water-soaked spots on leaves and fruit; can lead to plant death.	Use resistant varieties, improve drainage, and apply fungicides.
Fusarium Wilt	Caused by the fungus *Fusarium oxysporum*.	Yellowing and wilting of leaves; plant stunting.	Use resistant varieties, crop rotation, and soil sterilization.
Bacterial Wilt	Caused by *Ralstonia solanacearum*.	Wilting and yellowing of leaves; decay at the base.	Practice crop rotation, use resistant varieties, and avoid waterlogging.
Leaf Spot	Caused by various fungi (e.g., *Septoria lycopersici*).	Circular spots on leaves; premature leaf drop.	Remove infected leaves, apply fungicides, and improve air circulation.
Powdery Mildew	Caused by the fungus *Leveillula taurica*.	White powdery spots on leaves; reduced photosynthesis.	Apply fungicides, improve ventilation, and avoid overhead watering.
Tomato Mosaic Virus	Virus transmitted by aphids, causing mottled leaves.	Stunting, leaf curling, and reduced yield.	Use virus-resistant varieties, control aphid populations, and practice good sanitation.

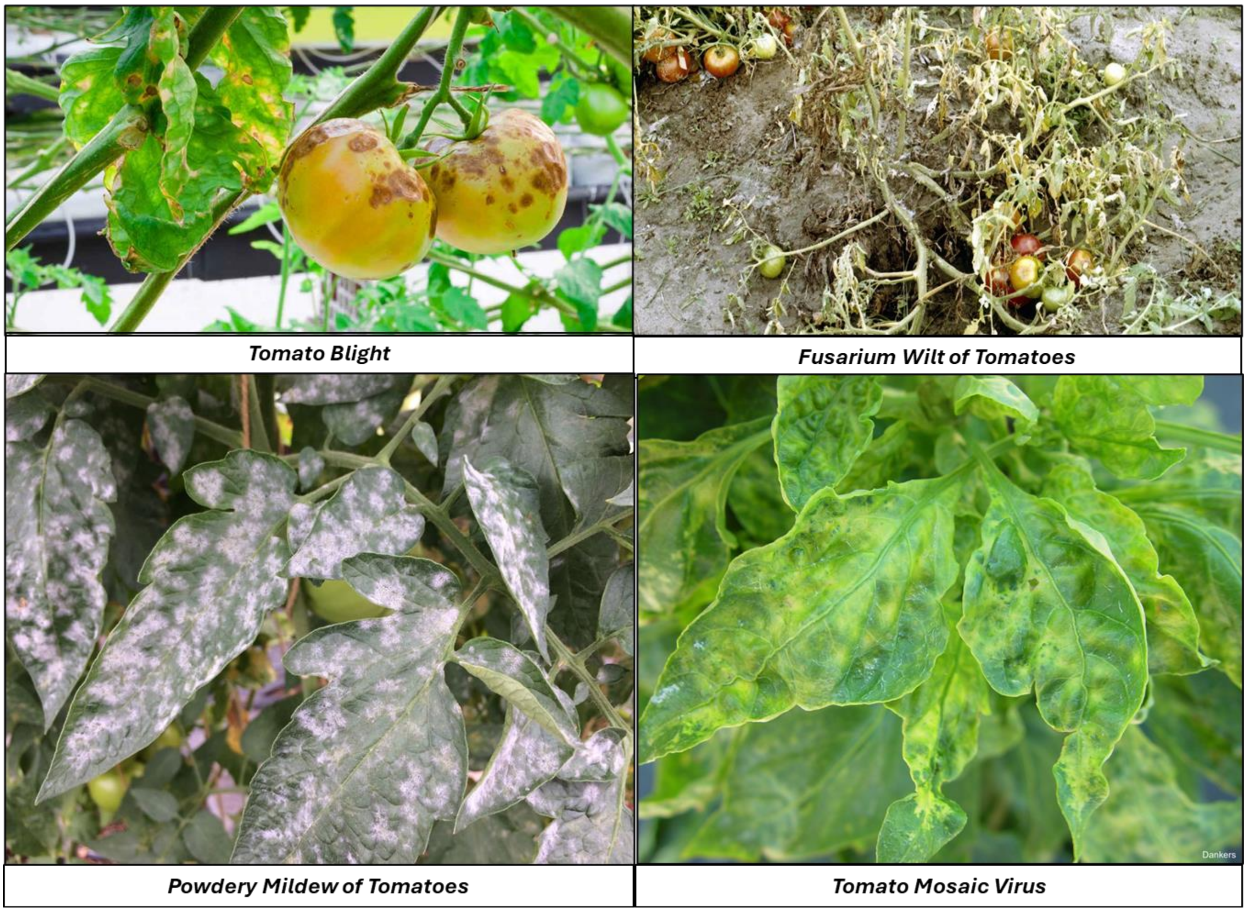


Figure 18: Most Common Diseases of Tomatoes

Effective management practices involve a combination of cultural practices, resistant varieties, and chemical controls tailored to specific diseases and local conditions. Regular monitoring or vigilance and timely intervention by the farmers are crucial to minimizing disease impact on Tomato crops in Sri Lanka.

When chemical control is practiced, only pesticides that are registered in Sri Lanka should be used at DOA recommended amounts.

Chemical Control of Pests and Diseases

Chemical Control of Pests

Pest	Insecticide	Dosage	Management
Tomato Fruit Borer	Cypermethrin	1-2 ml per liter of water	Apply during early infestation; repeat every 7-10 days. Monitor for eggs and larvae; consider using pheromone traps to reduce adult populations.
Thrips	Imidacloprid	0.5-1 ml per liter of water	Monitor regularly; apply at first signs of infestation. Use yellow sticky traps to catch adults and reduce populations. Ensure

Pest	Insecticide	Dosage	Management
			thorough coverage of the undersides of leaves.
Whiteflies	Acetamiprid	0.5-1 ml per liter of water	Use sticky traps for monitoring; apply when populations rise. Rotate insecticides to prevent resistance; consider introducing natural predators like ladybugs.
Aphids	Malathion	2 ml per liter of water	Apply during early infestation; ensure thorough coverage. Check for beneficial insects; avoid broad-spectrum insecticides that may harm them.
Spider Mites	Bifenthrin	0.5-1 ml per liter of water	Use miticides; monitor plant health regularly. Increase humidity around plants to deter mites; consider using predatory mites for biological control.
Leafminers	Spinosad	1-2 ml per liter of water	Apply when larvae are first observed; target infested leaves directly. Use reflective mulches to deter adult flies.
Cutworms	Chlorpyrifos	2-3 ml per liter of water	Apply in the evening; target the base of plants and surrounding soil. Use barriers like collars around seedlings to prevent feeding.
Cabbage Looper	Bacillus thuringiensis (Bt)	1-2 ml per liter of water	Apply when larvae are small; repeat every 5-7 days if needed. Monitor for signs of leaf damage; maintain healthy plant growth to reduce susceptibility.

Chemical Control of Diseases

Disease	Chemical	Dosage	Management
Early Blight	Chlorothalonil	2-3 g per liter of water	Apply at first sign of disease; repeat every 10-14 days. Maintain good air circulation and avoid overhead watering.
Late Blight	Metalaxyl + Mancozeb	2-3 g per liter of water	Apply preventively during high humidity; repeat every 7-10 days. Remove infected plant debris and practice crop rotation.
Fusarium Wilt	Trichoderma spp.	Follow label instructions	Apply as a soil drench at transplanting; improve soil drainage and organic matter. Rotate with non-susceptible crops.

Disease	Chemical	Dosage	Management
Bacterial Wilt	Copper Oxychloride	3-4 g per liter of water	Apply at the first sign of infection; ensure thorough coverage. Practice good sanitation and avoid working in wet fields.
Powdery Mildew	Potassium Bicarbonate	2-3 g per liter of water	Apply preventively; repeat every 7-14 days. Increase air circulation and avoid excessive nitrogen fertilization.
Tomato Mosaic Virus	No chemical control (virus)	N/A	Manage with resistant varieties; remove and destroy infected plants. Control aphids that transmit the virus.
Alternaria Leaf Spot	Mancozeb	2-3 g per liter of water	Apply at first sign of disease; repeat every 10-14 days. Practice crop rotation and maintain plant spacing for airflow.
Root Knot Nematodes	Nematicides (e.g., Ethoprop)	Follow label instructions	Apply to soil before planting; practice crop rotation and use resistant varieties.

Guidelines for the Safe Use of Pesticides and Other Agro-Chemicals

1. Personal Protective Equipment (PPE)
    - Wear gloves, masks, goggles, and long-sleeved clothing to minimize chemical exposure.
2. Proper Training
    - Ensure all personnel are trained in safe handling and application techniques, with regular refresher courses.
3. Correct Dosage and Application
    - Follow manufacturer's instructions to avoid overuse and environmental harm.
4. Timing of Application
    - Apply pesticides early morning or late afternoon to reduce evaporation and protect beneficial insects. Avoid pre-rain application.
5. Buffer Zones
    - Maintain buffer zones around water bodies to prevent contamination.
6. Mixing and Loading
    - Mix pesticides in designated areas away from water sources and use proper containment.

7. Safe Storage
   - Store pesticides in a cool, dry place, out of reach of children and elder people and animals, with proper labeling.

8. Disposal of Containers
   - Dispose of containers according to local regulations and do not reuse them.

9. Monitoring and Record Keeping
   - Keep records of pesticide applications and monitor pest populations regularly.

10. Integrated Pest Management (IPM)
   - Combine chemical controls with other practices to reduce pesticide reliance.

11. Emergency Procedures
   - Have emergency procedures for accidental exposure or spills, including first-aid kits and contact numbers.

12. Environmental Impact Assessments
   - Conduct assessments to understand the impact on ecosystems and human health.

HARVESTING

Harvesting tomatoes involves observing both external and internal signs of maturity. Here's a guide to help you determine when to pick your tomatoes:

External Maturity Signs

1. Colour: Tomatoes should exhibit a deep, consistent color. For most varieties, this means a vibrant red, but some varieties may be yellow, orange, or even purple when ripe.
2. Firmness: Gently squeeze the tomato. It should feel firm but yield slightly to pressure. If it feels too soft, it may be overripe.
3. Skin Texture: Look for a glossy sheen on the skin. Dull skin may indicate that the tomato is not fully ripe.
4. Size: Check the expected size for the specific variety you are growing. Each type of tomato has its own size range for maturity.
5. Stem Color: The stem attached to the tomato should be brown or dry. A green stem can indicate that the fruit is not yet ripe.
6. Leaves: The leaves of the plant may start to yellow as the tomatoes ripen. This can be a sign that the plant is focusing its energy on ripening the fruit.

Internal Maturity Signs

1. Seed Colour: Cut the tomato in half. The seeds should be fully developed and have a gelatinous coating. If the seeds are still white or underdeveloped, the tomato may need more time on the vine.
2. Flavour: Ripe tomatoes should have a sweet, balanced flavor. Taste testing is a great way to determine internal ripeness.
3. Texture: The flesh should be juicy and not overly watery. A ripe tomato will have a good balance of firmness and juiciness.

Harvesting Tips

1. Time of Day: It's best to harvest tomatoes in the morning when the temperatures are cooler. This helps preserve their freshness.
2. Cutting: Use scissors or pruning shears to cut the tomatoes from the vine, leaving a small portion of the stem attached to avoid damage.
3. Handling: Handle tomatoes gently to prevent bruising and place them in a soft container to avoid squishing.

POST-HARVEST HANDLING

Post-harvest handling of tomatoes is crucial for maintaining their quality and extending their shelf life. Here are the key steps and storage conditions involved in this process:

Table 1: Post-Harvest Tips for Farmers

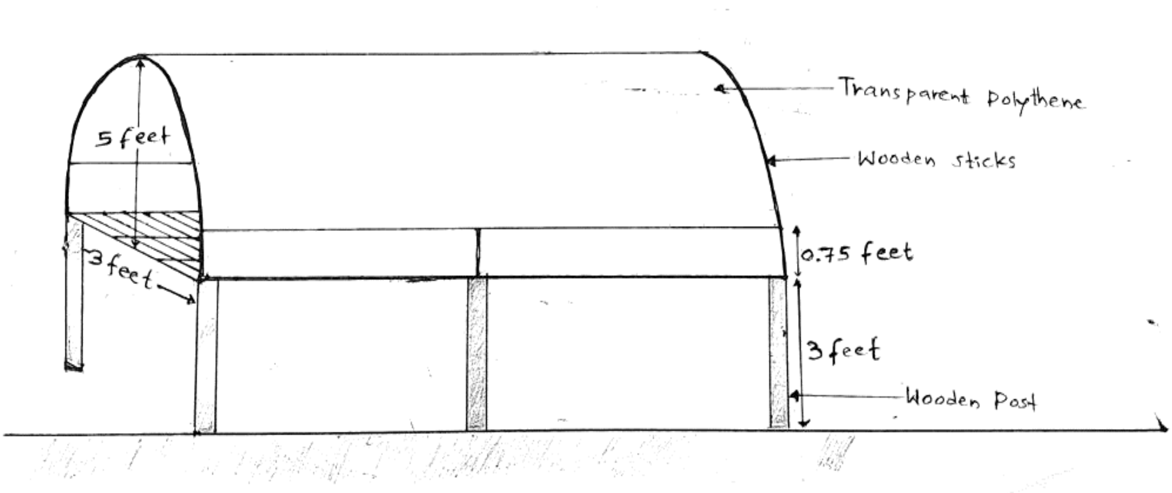
Post-Harvest Handling Tips for Farmers

- Place harvested crop under shade as soon as possible after harvest
- Avoid direct contact of the harvested crop with the ground
- Do not store in hot and unventilated spaces
- Prepare produce for market making sure they are not bruised or scared
- Place produce in proper containers as required by the market
- Bring product to market as soon as possible after harvest
- Workers handling product must be healthy and must wear protective gear to avoid contamination

1. Harvesting
    a. Timing: Tomatoes should be harvested at the right stage of ripeness, ideally when they are fully coloured but still firm.
    b. Gentle Handling: Avoid bruising by handling the tomatoes gently and using proper tools like clippers to detach them from the vine.
2. Cleaning
    a. Washing: After harvesting, tomatoes should be washed to remove dirt and any pesticide residues. Use clean, potable water.
    b. Drying: Allow the tomatoes to dry completely to prevent mold growth during storage.
3. Grading and Sorting
    a. Quality Assessment: Sort tomatoes based on size, color, and any signs of damage or disease. Remove any damaged tomatoes to prevent spoilage.
    b. Packaging: Use breathable packaging materials that allow for air circulation, such as cardboard boxes or mesh bags.

4. Storage Conditions
    a. Temperature: Ideally, store tomatoes at temperatures between 55°F to 70°F (13°C to 21°C). Avoid refrigeration as it can adversely affect flavor and texture.
    b. Humidity: Maintain high humidity levels (around 85-90%) to prevent dehydration but ensure good airflow to reduce the risk of Mold.
    c. Light Store tomatoes in a dark or shaded area to prevent light exposure, which can cause ripening to accelerate.
5. Ripening
    a. Controlled Ripening: If tomatoes are harvested unripe, they can be kept in a controlled environment with ethylene gas to promote uniform ripening.
    b. Monitoring: Regularly check for ripeness and spoilage and remove any overripe or damaged fruit.
6. Transportation
    a. Careful Transport: During transportation, ensure that tomatoes are well-protected to avoid bruising. Use padded containers and avoid stacking heavy items on top.
7. Shelf Life
    a. Expected Duration: Under optimal storage conditions, tomatoes can last for about 1 to 2 weeks. However, the shelf life may vary depending on the initial quality and handling practices.

ANNEX 1: LOW-COST ELEVATED NURSERIES



- **Height - 2.5 - 3 feet**
- **Length - 15 feet**
- **Width - 3 feet**
- **15 Nursery trays**
- **810 Seedlings with 54-hole trays**
- **1,500 Seedlings with 100-hole trays**
- **Polythene bags - 650 bags (4 by 5 inches)**

ANNEX 2: SOIL TEST RESULTS AND FERTILIZER RECOMMENDATIONS

Badulla TOMATOES Soil Test Results

Sample Code	Lab No.	pH	OM	EC	Ca	Mg	K	NH_4-N	P	S	Cu	Fe	Mn	Zn	CEC	Ca/Mg	Mg/K	Ca/K	Ca+Mg/K	Ca sat
		1:2.5, H_2O	%	µS/cm	Exchangeable (meq/100g)					Available (ppm)					cmol/kg					
Erabadda – 1	R9 483	6.21	2.15	95.70	1.70	0.92	1.05	263.60	53.00	261.00	4.20	48.80	6.90	3.00	3.70	1.85	0.88	1.62	2.50	46.32
Erabadda – 2	R10 483	6.35	2.29	102.70	1.85	0.69	0.3	346.40	208.00	95.00	9.10	366.00	82.00	4.00	2.80	2.68	2.30	6.17	8.47	65.14
Puranwela	W1 483	6.25	2.02	108.30	2.78	1.83	0.61	247.90	240.00	20.00	6.70	416.00	15.20	4.40	5.20	1.52	3.00	4.56	7.56	53.26
Diwurumwela	W2 483	5.95	2.96	93.40	3.25	1.55	1.02	323.40	352.00	29.00	8.90	920.00	26.40	5.70	5.80	2.10	1.52	3.19	4.71	55.84
Alawathugoda – 1	W3 483	6.63	3.09	85.10	4.43	1.96	1.88	224.80	233.00	301.00	7.30	146.20	30.00	6.10	8.30	2.26	1.04	2.36	3.40	53.57
Alawathugoda – 2	W4 483	6.44	3.77	89.80	3.46	1.25	1.42	215.70	225.00	36.00	7.80	328.00	29.20	6.70	6.10	2.77	0.88	2.44	3.32	56.44
Gawarammana	W5 483	6.51	2.02	99.80	3.41	1.89	1.17	217.00	307.00	31.00	7.10	830.00	13.00	5.00	6.50	1.80	1.62	2.91	4.53	52.70

Interpretation:

- Low Potassium in two samples
- Low Sulphur in 3 samples
- Sulphur very high in two samples. Could be error from the Lab
- Copper and Zinc deficient
- Mn deficient except in one sample
- CEC low
- Cation ratios are narrow
- Calcium saturation is low except in one sample

Fertilizers:

- Nitrogen as required as Urea
- MOP for only two sites
- MgSO4
- CaCO3 at land preparation
- Foliar Micronutrients T-Flush

Plot/Application	Unit	Initial	Development	Production
Urea	Kg	6.38	7.65	12.76
MOP	Kg	5.15	6.18	10.31
MgSO4	Kg	4.50	5.40	9.00
Applications per Week		2		
Phosphoric Acid (ml)	ml	384.0	384.0	384.0
Application every two weeks				

Apply Calcium in the form of CaCO3 at a rate of 200 Kg/Half Acre during land preparation
Foliar Applications of Micro Nutrients (T-Flush 100 ml/16 L) Are also Recommended weekly. Very important

ANNEX 3: FERTIGATION PROTOCOL

Management of the Irrigation System

1. Turn irrigation pump on and allow the operating pressure of the system to become stable at the correct operating pressure (1 Bar to 2 Bar).
2. When pressure is stable, make sure venturi system is working correctly using only water in the fertigation tank or container.
3. Once venturi system is checked, proceed to fertigate with the fertilizer solution.
4. After fertigation, allow the system to continue to apply irrigation water to the plot for at least 10 minutes in order to flush out any fertilizer solution residue remaining in the system.
5. Make sure to apply Phosphoric acid every two weeks as recommended to make sure system remains unclogged by deposits of calcium salts.



Using Fertigation Solutions

1. Carefully follow "*Irrigation and Fertigation Recommendations"* issued by the ISP to make sure the right amounts and types of fertilizer materials are used for fertigation.
2. To prepare the fertigation solution, accurately weigh the correct amounts of fertilizer materials using a portable weighing scale.
3. Mix the weighed fertilizer material with water in an appropriate container such as a 20-litre plastic bucket using a clean wooden stick to stir the fertilizer material into the water to make sure all the fertilizer material is dissolved.
4. In case there is a fertilizer material that is not 100% soluble in water such as TSP, mix for at least 5 minutes to dissolve as much material as possible.
5. Filter the fertigation solution into the fertigation container to be used with the venturi system (fertigation tank or container) using a cloth filter such as an old t-shirt or similar.
6. After filtering, the fertilizer material left on the cloth filter when using a partially soluble fertilizer material such as TSP must be saved into a container to be used in the next fertigation with the same material.

7. Close the main valve of the irrigation system and open the valves of the venturi system to force the irrigation water to flow through the venturi system. This will create the necessary vacuum to suck the fertigation solution into the irrigation system to be distributed throughout the plot and applied to the crop.
8. After the fertigation solution is applied, add clean water to the fertigation container and allow this water to flow though the venturi system to clean it.
9. Open the main valve and close the venturi system valves to allow for normal irrigation to resume.



ANNEX 4: SAFE USE OF PESTICIDES BY FARMERS

The ASMP does not recommend the use of pesticides except on an emergency basis when the survival of the crop is in eminent danger. When pesticides are required, the road map to assure their safe use is as follows:

- Use only recommended and approved agrochemicals that have not expired
- Store chemicals in well-ventilated storage boxes, rooms or warehouses that are kept locked and that are built for this purpose
- Use only clean and calibrated sprayers dedicated to the chemicals being sprayed only i.e. weed killer containers should not be used to spray fungicides
- Use measuring devices to accurately measure recommended dosages or amounts of the chemicals
- Mix spray solutions or suspensions thoroughly with clean water and away from the field to be sprayed avoiding spillages
- Pour leftover mixes together with new mixes of the same product instead of discarding them in the soil or in streams
- Spray only in the early morning or late afternoon to minimize the effect of temperature and wind on the spray operation
- Spray equipment operators must wear protective clothing and equipment in accordance with the toxicity of the chemical being sprayed
- Dispose of chemical containers properly either by handing them to the proper authorities (Ministry of the Environment) or by storing them in the proper location after they have been punctured to avoid stagnant water. Burning of hazardous chemicals is to be avoided
- Keep sprayers and other spray equipment in good working condition