


SEED CORN

TECHNICAL OPERATIONAL MANUAL

AGRICULTURAL SECTOR MODERNIZATION PROJECT (ASMP)

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INTRODUCTION

The Origin of Corn

Corn originated in Mexico, where it was domesticated from a wild grass called teosinte around 9,000 years ago. From Mexico, corn has spread almost all over the world:

1. Early Spread: Cultivation of corn spread throughout the Americas by 2500 BCE, with Native Americans playing a key role in its dissemination.
2. Columbian Exchange: After Columbus' voyages, corn was introduced to Europe and other parts of the world during the Columbian Exchange.
3. Global Adoption: Corn's adaptability and high yields led to its widespread adoption in many countries, becoming a major staple crop globally.

Key Factors in its Spread:

1. Trade: Trade routes facilitated the movement of corn seeds and knowledge of cultivation techniques.
2. Cultural Exchange: The exchange of ideas and knowledge between different cultures contributed to the spread of corn cultivation.
3. Agricultural Practices: The development of improved agricultural practices, such as irrigation and fertilization, increased corn yields and encouraged its wider adoption.

Corn's journey from its origins in Mexico to becoming a global staple crop is a testament to the power of human ingenuity and the interconnectedness of the world.

Economic Importance of Corn

Corn has immense global economic significance due to its diverse applications and widespread cultivation:

Food Production:

1. Livestock Feed: Corn is a primary ingredient in animal feed, crucial for raising livestock like poultry, pigs, and cattle. This supports global meat and dairy production, impacting food security and economies worldwide.
2. Human Consumption: While less common in many developed countries, corn is a significant food source in many parts of the world, particularly in developing nations. It's used in various forms, including cornmeal, tortillas, and other staple foods.
3. Processed Foods: Corn is a key ingredient in many processed foods, from sweeteners and snacks to biofuels.

Industrial Uses:

1. Biofuels: Corn is a major source for ethanol production, a biofuel used to supplement gasoline. This has significant implications for energy independence and reducing reliance on fossil fuels.
2. Industrial Products: Corn is used to produce a wide range of industrial products, including starch, glucose, and other chemicals used in various manufacturing processes.

Global Trade:

1. Major Commodity: Corn is a major global commodity, with significant international trade flows. This impacts global food prices, trade balances, and the economies of both producing and importing countries.
2. Economic Driver: Corn production and trade support numerous jobs and contribute significantly to the economies of many countries, particularly in agricultural regions.

Economic Impacts:

1. Food Security: Corn plays a crucial role in global food security, providing a vital source of calories and nutrients for both humans and livestock.
2. Economic Growth: The corn industry contributes significantly to economic growth in many countries through job creation, agricultural development, and related industries.
3. Price Volatility: Fluctuations in corn prices can have significant economic impacts, affecting food prices, consumer spending, and the profitability of livestock producers.

Corn's versatility and widespread use make it a cornerstone of the global economy. Its impact extends far beyond agriculture, influencing energy production, industrial processes, and the global food system. Understanding the economic significance of corn is crucial for addressing issues related to food security, energy independence, and sustainable development.

Economic Importance of Seed Corn

Seed corn holds significant global economic importance:Foundation of Food Production:

1. Yield Enhancement: High-quality seed corn is the foundation for increased crop yields. Improved genetics lead to higher productivity, benefiting farmers and contributing to global food security.
2. Disease and Pest Resistance: Seed corn with built-in resistance to diseases and pests reduces crop losses, increasing farm profitability and ensuring a stable food supply.
3. Drought Tolerance: In regions facing water scarcity, drought-resistant seed corn is crucial for maintaining production and mitigating the impacts of climate change.

Economic Driver:

1. Seed Industry: The seed corn industry itself is a major economic driver, creating jobs in research, development, production, and distribution.
2. Related Industries: The seed corn industry supports a vast network of related industries, including agricultural equipment manufacturers, fertilizer producers, and input suppliers.

Global Trade:

1. International Trade: Seed corn is a significant component of international agricultural trade, with major exporters and importers playing crucial roles in the global market.
2. Technological Transfer: The global seed trade facilitates the transfer of advanced seed technologies to developing countries, improving agricultural productivity and livelihoods.

Addressing Global Challenges:

1. Food Security: Seed corn plays a vital role in addressing global food security challenges by increasing crop yields and improving the resilience of agricultural systems.
2. Climate Change: The development and deployment of climate-resilient seed corn varieties are crucial for adapting to the changing climate and ensuring sustainable food production.

Seed corn is not just a seed; it's a cornerstone of modern agriculture and a critical factor in global food security and economic development.

OPTIMAL GROWING CONDITIONS

Corn thrives in warm, sunny conditions with ample moisture:

Climate:

1. Warm Temperatures: Corn is a warm-season crop. Ideal temperatures for growth range from 77°F to 91°F (25°C to 33°C) during the day and 62°F to 74°F (17°C to 23°C) at night.
2. Sunlight: Corn requires at least 6-8 hours of direct sunlight per day.
3. Moisture: Adequate and well-distributed rainfall or irrigation is crucial. Corn has a high-water demand, especially during the pollination and grain-filling stages.
4. Frost-free Period: A long frost-free growing season (typically 130 days or more) is essential for successful corn production.

Soil:

1. Well-drained: Corn requires well-drained soils to prevent root rot.
2. Fertile: Corn is a heavy feeder and benefits from fertile soils rich in organic matter.
3. Neutral to Slightly Acidic: The ideal soil pH for corn is between 6.0 and 7.5.

LAND PREPARATION

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 Seed Corn as the crop is susceptible to several root diseases. Good internal drainage provided by 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 Seed Corn.

Evacuation Drainage

For small plots, a “U” type evacuation 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:

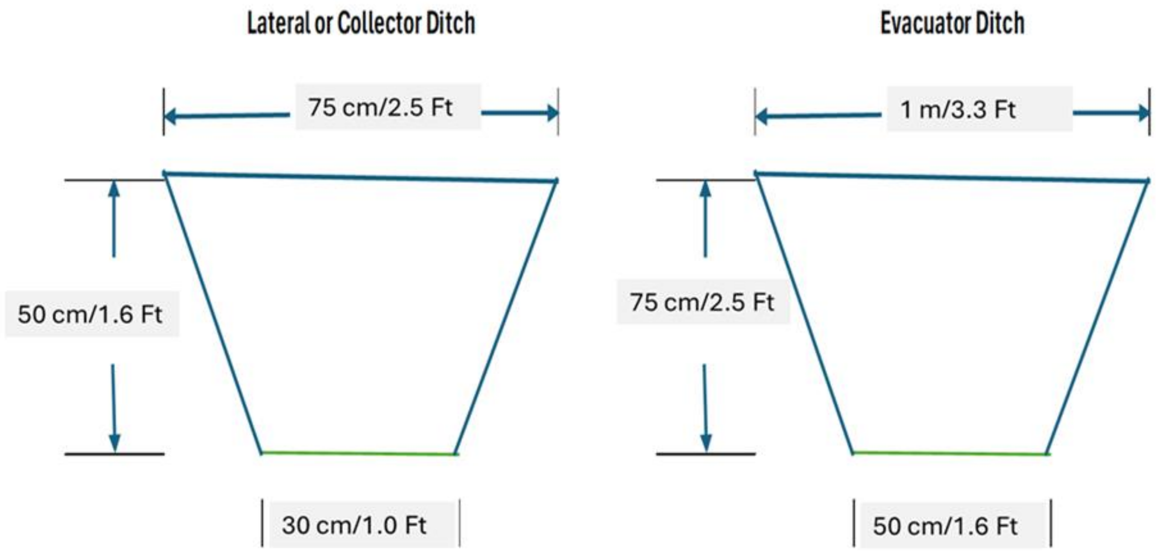


Figure 1: Size of Drainage Ditches

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.

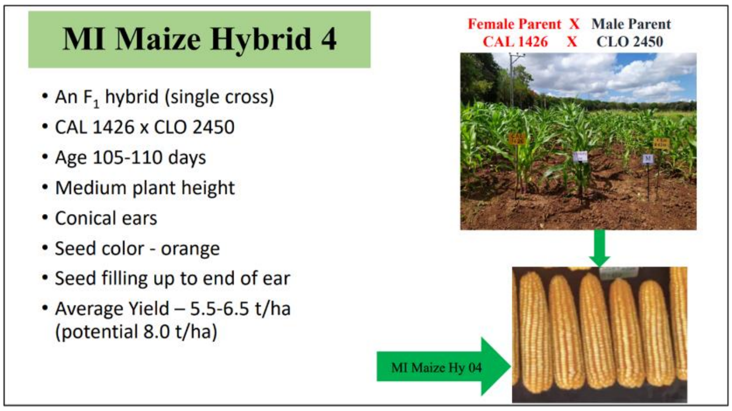
Figure 2: Draining Wet Spots Using Surface Drainage

VARIETIES

The MI (Maize Improved) Hybrids such as the 04 are the preferred varieties to produce seed corn in Sri Lanka. The MI Hybrids are developed by the DOA through research to enhance yield, disease resistance, and adaptability to local growing conditions.

Some popular MI hybrid varieties include:

1. MI 1: Known for its high yield potential and good resistance to pests and diseases. It is suitable for various agro-climatic zones in Sri Lanka.
2. MI 2: Offers a shorter growth period and is favored for its adaptability to both wet and dry seasons. It also exhibits good grain quality.
3. MI 3: This hybrid is appreciated for its drought resistance and high kernel quality, making it a preferred choice among farmers.
4. MI 4: This hybrid is especially popular due to its high yield potential and excellent agronomic traits. It is characterized by:
    a. Drought Resistance: MI 04 performs well under water-scarce conditions, making it suitable for areas with irregular rainfall.
    b. Disease Resistance: It shows good resistance to common maize diseases such as leaf blight and ear rot.
    c. Quality: The grains are known for their high quality, making them suitable for both human consumption and animal feed.



HIGH DENSITY PLANTING

Planting Equipment

Seed corn is planted by direct seeding or sowing the corn seeds into the ground by hand or by using a manual planter seeding machine which is a hand-operated agricultural tool designed for planting seeds like corn, peanuts, and soybeans. Typically, it consists of a hopper to hold seeds, a mechanism to dispense them at regular intervals, and a handle for pushing or pulling the device along rows in the field.

The planter may feature adjustable settings to control seed depth and spacing, ensuring optimal growth conditions. Some models include a furrower to create planting rows, while others may have a covering mechanism to ensure seeds are adequately buried after planting. This tool is useful for small-scale farmers or gardeners who prefer a more hands-on approach to planting.

Figure 3: Manual Seeder Planter

Figure 4: Using the Manual Seeder Planter

Block Planting

Block planting of maize for seed is a common agricultural practice where maize plants are arranged in a block or square pattern rather than in single rows. This planting method is used to maximize space utilization, improve pollination efficiency, and increase yields.

In a block planting layout for maize, both male and female rows are typically incorporated to ensure proper pollination and ultimately higher yields:

1. Male Rows :
   a. Male rows consist of maize plants that produce pollen. These plants are also known as tassel-bearing plants.
   b. The male rows are usually planted at regular intervals throughout the block. The number of male rows can vary depending on the size of the block and the specific planting scheme.
   c. The tassels at the top of the male plants release pollen, which is essential for fertilizing the silks on the female plants.

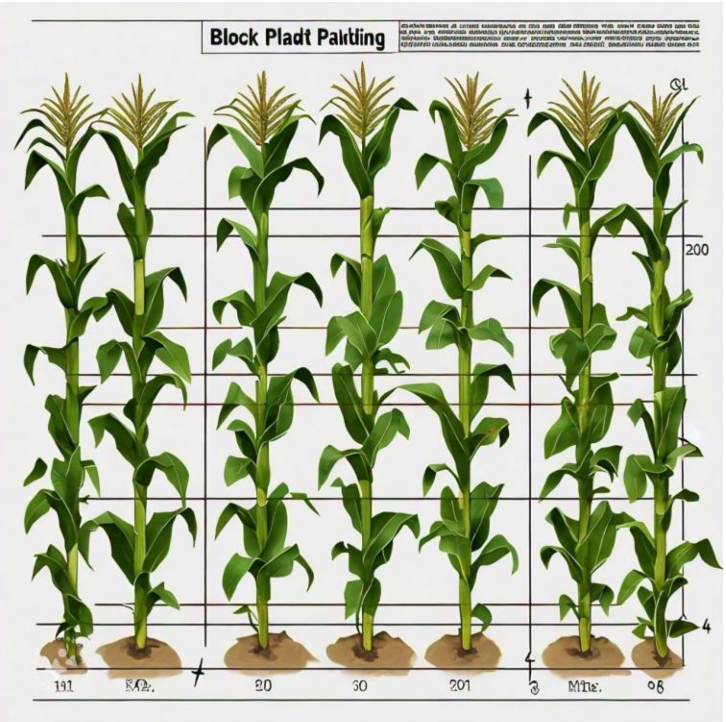


Figure 5: Block Planting of Maize in a 2:3 Block

2. Female Rows :
   a. Female rows consist of maize plants that produce ears with silks. These plants are also known as ear-bearing plants.
   b. The female rows are typically planted in between the male rows in a staggered pattern. This arrangement ensures that the silks from the female plants are in close proximity to the pollen from the male plants for effective pollination.
   c. The silks are the elongated styles that emerge from the ears of the maize plant. Each silk is connected to a potential kernel on the ear and must receive pollen for fertilization to occur.

By planting male and female rows in a block pattern, the chances of successful pollination and kernel development are increased. This method helps ensure that each silk on the female plants receives an adequate amount of pollen, leading to well-filled ears and higher maize yields.

Block planting with male and female rows is a practical strategy for optimizing pollination efficiency and enhancing the productivity of maize crops. In block planting of maize, the arrangement of male and female rows can impact pollination and hence the yield of maize. For optimal pollination and yield, a common recommendation is to have a ratio of 1:4 or 1:5 male rows to female rows.

Figure 6: Block Planting of Seed Corn in a 1:4 Block

Therefore, for every 1 row of male plants (tassels), you should have approximately 4 to 5 rows of female plants (ears) in a block planting setup to ensure efficient pollination and ultimately maximize yield. Adjustments can be made based on specific conditions and requirements, but this ratio is a good starting point for planting maize in blocks.

When planting maize in a block with male rows and female rows in a 1:4 ratio, you need to follow a specific planting pattern to ensure proper pollination and maximize yields. Here's how you can configure the rows:

1. Male Rows:
   a. For every one row of male plants, you will have four rows of female plants. Male rows are essential for providing the pollen necessary for fertilizing the female plants.
   b. Plant the male rows at regular intervals throughout the block. The male rows should be evenly distributed to ensure adequate pollen dispersal.

2. Female Rows:
   a. For every one row of male plants, there will be four rows of female plants.
   b. Plant the female rows adjacent to the male rows. This proximity allows for efficient pollination by the male plants.

3. Spacing:
   a. Ensure appropriate spacing between the rows to allow for sufficient sunlight, air circulation, and space for the plants to grow without competing.
   b. The spacing will depend on the specific requirements of the maize variety you are planting.

By following this planting configuration with male rows and female rows in a 1:4 ratio, successful pollination is promoted, and optimal maize yields are achieved.

<u>Plant Spacing in a 1:4 Block</u>

The “Block” planting has two components. The “Block” row (male plants) is the “1” element in the 1:4 configuration and the “Open” or “Skip” rows (female plants) are the “4” element in the 1:4 configuration.

- Rows of block plants (male) should be 1.5 m apart and plants within these rows should be spaced at 0.2 m.
- Rows of open plants (female) should be 0.3 m apart and plants within these rows should be spaced at 0.3 m. The planting pattern for these female open rows is Zigzag or triangular.
- The population Density is 24,622 plants per half and Acre in this block planting system.
- Seed Required is 7.5 Kg assuming 5% losses and a seed count of 3,000 seeds per pound or 6,930 seeds per Kg, 2 seeds per planting hole
- Thinning to one vigorous plant per hole should be done after emergence

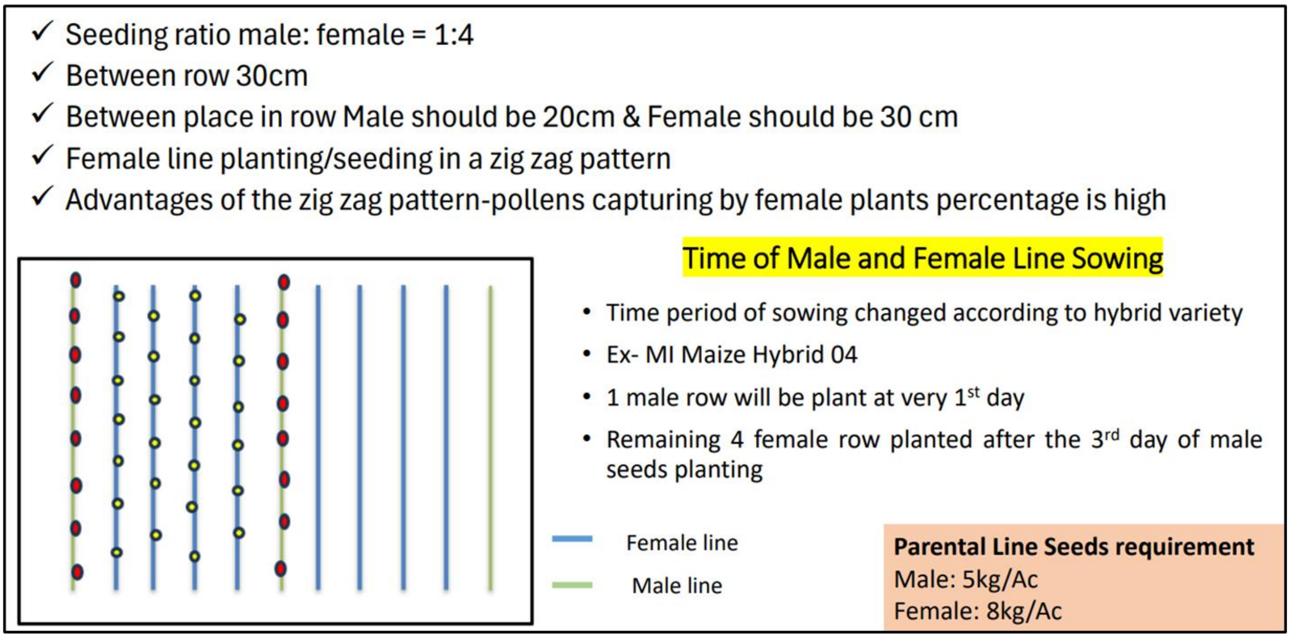


Figure 7: Seed Corn Planting Guide for a 1:4 Block Planting

IRRIGATION AND FERTIGATION

Irrigation

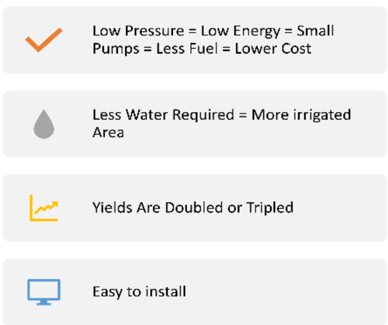
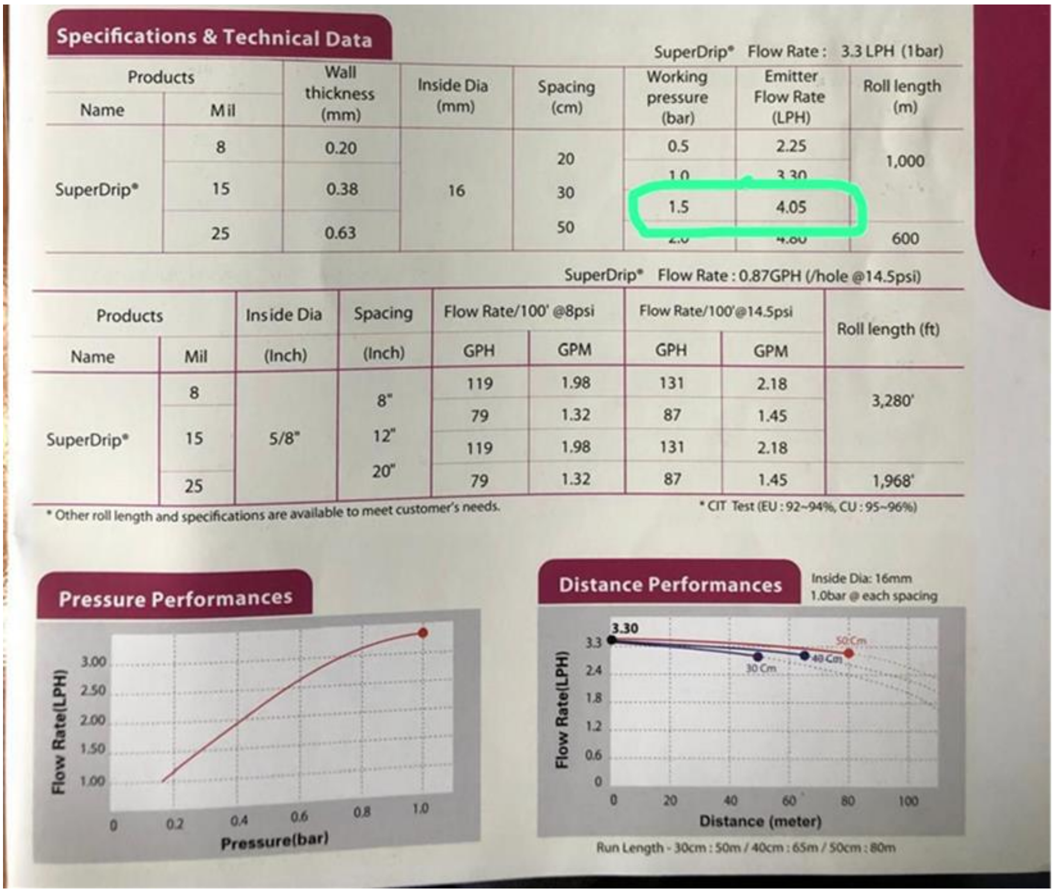


Figure 8: Advantages of Low-Pressure Irrigation

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 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 rate of the soil. For Seed Corn, the recommended irrigation system is a drip tape system that has emitters at every 30 cm with a discharge rate of 4 LPH (high discharge). One drip tape line is laid out in the middle of two rows of corn for watering the Seed Corn crop. The technical specifications are given in the following figure:



Specifications & Technical Data

SuperDrip* Flow Rate : 3.3 LPH (1bar)

Products		Wall thickness (mm)	Inside Dia (mm)	Spacing (cm)	Working pressure (bar)	Emitter Flow Rate (LPH)	Roll length (m)
Name	Mil						
SuperDrip*	8	0.20	16	20	0.5	2.25	1,000
	15	0.38		30	1.0	3.30	
					1.5	4.05	
	25	0.63		50	2.0	4.80	600

SuperDrip* Flow Rate : 0.87GPH (/hole @14.5psi)

Products		Inside Dia	Spacing	Flow Rate/100' @8psi		Flow Rate/100'@14.5psi		Roll length (ft)
Name	Mil	(Inch)	(Inch)	GPH	GPM	GPH	GPM	
SuperDrip*	8	5/8"	8"	119	1.98	131	2.18	3,280'
				79	1.32	87	1.45	
	15		12"	119	1.98	131	2.18	
	25		20"	79	1.32	87	1.45	1,968'

* Other roll length and specifications are available to meet customer's needs.

* CIT Test (EU : 92~94%, CU : 95~96%)

<u>New Irrigation Concepts</u>

- 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)

<u>Water Requirements</u>

Seed corn requires a consistent and adequate water supply throughout its growth cycle. Water stress can significantly impact yield and quality.

1. Daily Water Needs:
   a. Early Growth Stages: 2-5 mm per day
   b. Mid-Growth Stages: 5-10 mm per day (highest demand during pollination and grain filling)
   c. Late Growth Stages: 3-7 mm per day

2. Weekly Water Needs:
   a. Early Growth Stages: 14-35 mm per week
   b. Mid-Growth Stages: 35-70 mm per week
   c. Late Growth Stages: 21-49 mm per week

Important Considerations:

a. Soil Moisture: Maintaining adequate soil moisture (field capacity) is crucial. Avoid waterlogging, which can lead to root rot.
b. Irrigation: Irrigation is often necessary to supplement rainfall, especially during periods of drought.
c. Soil Type: Sandy soils have lower water-holding capacity than clay soils, requiring more frequent irrigation.
d. Weather Conditions: High temperatures and wind increase water loss through evapotranspiration, increasing water demand.

These values are subject to change based on environmental conditions, soil type, and management practices. It's recommended to refer to the specific FAO guidelines or local agronomic resources for precise coefficients.

Water Application

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. The Seed Corn consumptive water use is defined as 5.5 mm/Day in this manual.

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 corn plant, including canopy and root development,

	Vegetative	Flowering	Fruit Dvlmt
Kc Factor FAO	0.5	1.1	1.3

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 Seed Corn using the drip tape irrigation system.

Table 1: Irrigation Time to Apply the Seed Corn Consumptive Water Use

Irrigation Schedule	Emergence		Development		Maturity	
Irrigation Time (Hours/Minutes)	0	23	0	38	0	44

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

Seed corn has specific nutritional requirements to ensure healthy growth and optimal seed production. The key nutrients required by Seed Corn and their roles follow below:

1. Nitrogen (N): Essential for vegetative growth and overall plant health. It promotes leaf development and increases photosynthesis.
2. Phosphorus (P): Important for root development and energy transfer within the plant. It supports flowering and seed formation.
3. Potassium (K): Aids in water regulation, disease resistance, and overall plant vigor. It helps in the formation of strong stems and enhances the quality of the seeds.
4. Calcium (Ca): Vital for cell wall structure and stability. It also plays a role in nutrient uptake and enzyme activity.
5. Magnesium (Mg): A key component of chlorophyll, it is crucial for photosynthesis and helps in the absorption of other nutrients.
6. Sulfur (S): Important for protein synthesis and enzyme function. It contributes to the development of seed quality.
7. Micronutrients: These include zinc (Zn), manganese (Mn), iron (Fe), copper (Cu), and boron (B). While required in smaller quantities, they are essential for various physiological functions and overall plant health.

These nutritional requirements, especially Nitrogen, vary according to the phenological development of Seed Corn. The ASMP has introduced this new concept to fertigate Seed Corn and other crops.

Nitrogen Fertigation Based on the Phenology of the Crop

Seed Corn requires an effective nitrogen (N) application management for optimizing its growth, yield, and seed quality. Tailoring nitrogen fertilization to the phenological stages of Seed Corn is a crucial strategy for maximizing productivity and seed quality. By applying specific nitrogen rates at each phenological stage, growth and yield can be enhanced while minimizing environmental impacts and maximizing economic impacts. Careful management of Nitrogen fertilization ensures that Seed Corn cultivation remains both economically viable and ecologically sustainable.

The phenological stages and Nitrogen requirements of Seed Corn are described in the table below:

Table 2: Nitrogen Fertilization Based on the Phenology of Seed Corn

Plot Net Area	**0.20**
Applications per Week	**2**

Phenology	Time Period	Weeks	N Kg/Ha	Urea Kg/Ha	Urea Kg/Plot/Week	Urea Kg/Plot/Application
Germination	0 - 2 weeks	2	6.9	15	2	0.76
Seedling Development	2 to 4 weeks	2	20.8	45	5	2.29
Vegetative Growth	4 to 8 Weeks	4	55.4	120	6	3.05
Tasseling	8 to 10 weeks	2	48.5	105	11	5.34
Kernel Fill	10 - 14 weeks	4	41.5	90	5	2.29
Maturation	14 – 16 weeks	2	6.9	15	2	0.76
Total		16	180	391		

Fertigation Recommendations

The fertilizer application in the ASMP Clusters is based on soil test results. The Ampara Seed Corn Cluster soil tests results will illustrate the process to develop fertigation recommendations. In addition, Annex 1 contains all the soil tests and the global fertilizer recommendations for all the Seed Corn Clusters.

The results of the soil tests for Ampara Seed Corn indicated the following:

Low Organic Matter
Low P
Low K
Low Micronutrients especially S, Cu and Zn
Low CEC and Cation Ratios
Ca Saturation very low

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

Urea
TSP
MOP
$MgSO_4$ as a source of S
$CaSO_4$ at land preparation
Foliar Micronutrients

Based on the above considerations Nitrogen as Urea is applied according to the phenological stages of the crop as indicated above.

The recommended amounts of other nutrients to be applied through fertigation to the Seed Corn crop are shown in elemental and oxide forms below:

Recommendation	P	K	Mg
Kg/Ha	80.0	120.0	75.0
Lb/acre	80.0	120.0	75.0
Kg/Acre	36.4	54.5	34.1

Phosphoric Acid P (Kg/Ha)	10.0

Recommendation	P2O5	K2O	MgO
Kg/Ha	183.2	144.6	124.3
Lb/acre	183.2	144.6	124.3
Kg/Acre	83.3	65.7	56.5

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	P Acid	TSP	MOP	MgSO4
Fertilizer per Season	16	173	110	376

Each of these amounts of fertilizer materials is then adjusted percentage wise according to the phenological development of the crop.:

Kg/Acre	Emergence	Development	Maturity	Tot
P Acid	5.4	5.6	5.4	16
TSP	57.3	59.0	57.3	173
MOP	36.2	37.2	36.2	110
MgSO4	124.1	127.8	124.1	376

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 (Days)	Emergence	Development	Maturity	Tot
Weeks	4	6	6	16

Kg/Acre/Week	Emergence	Development	Maturity
P Acid	1.35	1.35	1.35
TSP	14.31	9.83	9.54
MOP	9.04	6.21	6.03
MgSO4	31.02	21.31	20.68

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

Kg/Acre/Application	Emergence	Development	Maturity
P Acid	0.674	0.674	0.674
TSP	7.156	4.915	4.771
MOP	4.519	3.104	3.013

MgSO4	15.510	10.653	10.340

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/Ha)
0.3	40	12	84	0.25

In other words, in a production area of 0.5 Acre, only 0.25 Acres will be receiving fertilizer as follows:

Kg/Plot/Application	Emergence	Development	Maturity
TSP	1.80	1.24	1.20
MOP	1.14	0.78	0.76
MgSO4	3.91	2.68	2.61

Phosphoric Acid is recommended every two weeks to keep the irrigation system free from clogging:

ml/Plot/Application	Emergence	Development	Maturity
Phosphoric Acid (ml)	100.8	100.8	100.8

Applications every two weeks

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

Foliar Applications of Micronutrients Are Also Recommended Every Week
Incorporate CaSO4 at land preparation after Compost and before the 2nd ploughing at a rate of 250 Kg/Plot

Irrigation and Fertigation Management Guide

To facilitate the application of water and nutrients to the Seed Corn crop, the ASMP is now issuing an “Irrigation and Fertigation Management Guide” to the farmers that gives week by week detailed instructions. This guide summarizes all the water and nutrients applications for the crop:

Per Plot Per Application

			Irrigation		Kg/Application				ml	
Week	Growth Face	Phenology	Hours	Minutes	Urea	TSP	MOP	MgSO4	Phosphoric Acid (ml)	Micronutrients
1	Emergence	Germination	0	23	0.4	1.8	1.1	3.9		Foliar
2		Germination	0	23	0.4	1.8	1.1	3.9	101	Foliar
3		Seedling Development	0	23	1.2	1.8	1.1	3.9		Foliar
4		Seedling Development	0	23	1.2	1.8	1.1	3.9	101	Foliar
5	Development	Vegetative Growth	0	38	1.5	1.2	0.8	2.7		Foliar
6		Vegetative Growth	0	38	1.5	1.2	0.8	2.7	101	Foliar
7		Vegetative Growth	0	38	1.5	1.2	0.8	2.7		Foliar
8		Vegetative Growth	0	38	1.5	1.2	0.8	2.7	101	Foliar
9		Tasseling	0	38	2.7	1.2	0.8	2.7		Foliar
10		Tasseling	0	38	2.7	1.2	0.8	2.7	101	Foliar
11	Maturity	Kernel Fill	0	44	1.2	1.2	0.8	2.6		Foliar
12		Kernel Fill	0	44	1.2	1.2	0.8	2.6	101	Foliar
13		Kernel Fill	0	44	1.2	1.2	0.8	2.6		Foliar
14		Kernel Fill	0	44	1.2	1.2	0.8	2.6	101	Foliar
15		Maturation	0	44	0.4	1.2	0.8	2.6		Foliar
16		Maturation	0	44	0.4	1.2	0.8	2.6	101	Foliar

Two Applications per Week Except Phosphoric Acid Every Two Weeks

Incorporate CaSO4 at land preparation after Compost and before the 2nd ploughing at a rate of 250 Kg/Plot

Annex 2 gives a practical guide on how to fertigate at the field level.

WEED CONTROL

Only mechanical weed control practices are to be used for Seed Corn cultivation, including within the narrow width of the planting rows. Herbicides are not allowed because of their toxicity.

The most common mechanical weed control practices are:

1. Cultivation with a tractor using a rotavator implement in the early stages of growth of the crop
2. Motorized weed cutters that use plastic cords to cut weeds (weed eaters)
3. Workers using bush knives or any other cutting or chopping tool
4. Plastic agricultural mulch

A production system using high beds, high discharge drip tape irrigation and plastic mulch is worth exploring. Such a system should increase the internal drainage of the soil inside the high beds, allow for irrigation and fertigation practices through the high discharge drip tape irrigation system and should provide total weed control through the plastic mulch.

PEST AND DISEASE MANAGEMENT

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

Quantity Intensity	Coverage Severity		
	Quantity		
Intensity	Low	Medium	High
Low	Observation	Observation	Localized
Medium	Spot Treatment	Localized	Full Treatment
High	Localized Treatment	Full Treatment	Full Treatment

Most Common Pests in Sri Lanka

Pest	Description	Damage	Management
Fall Armyworm	A caterpillar pest that feeds on leaves and growing points of corn plants.	Causes significant leaf damage, reducing photosynthesis and yield.	Monitor fields regularly; use insecticides if thresholds are exceeded; encourage natural predators.
Asian Corn Borer	A moth whose larvae tunnels into stalks and ears of corn.	Leads to stalk weakening and ear damage, affecting yield quality.	Use resistant varieties; apply insecticides at the larval stage; implement crop rotation.
Corn Rootworm	Larvae of this beetle feed on corn roots, leading to plant instability.	Results in stunted growth and increased susceptibility to lodging.	Rotate crops; use resistant hybrids; apply soil insecticides if necessary.
Aphids	Small sap-sucking insects that can transmit viruses.	Causes leaf curling and can transmit diseases, impacting plant health.	Use insecticidal soaps or natural predators; monitor for virus symptoms.
White Grub	Larvae of scarab beetles that feed on roots.	Can severely damage root systems, leading to wilting and yield loss.	Apply nematodes for biological control; practice crop rotation; monitor soil health.
Cutworms	Caterpillars that cut young plants at the soil level.	Can cause significant stand loss, especially in seedlings.	Use protective collars; apply insecticides at planting; practice good field hygiene.

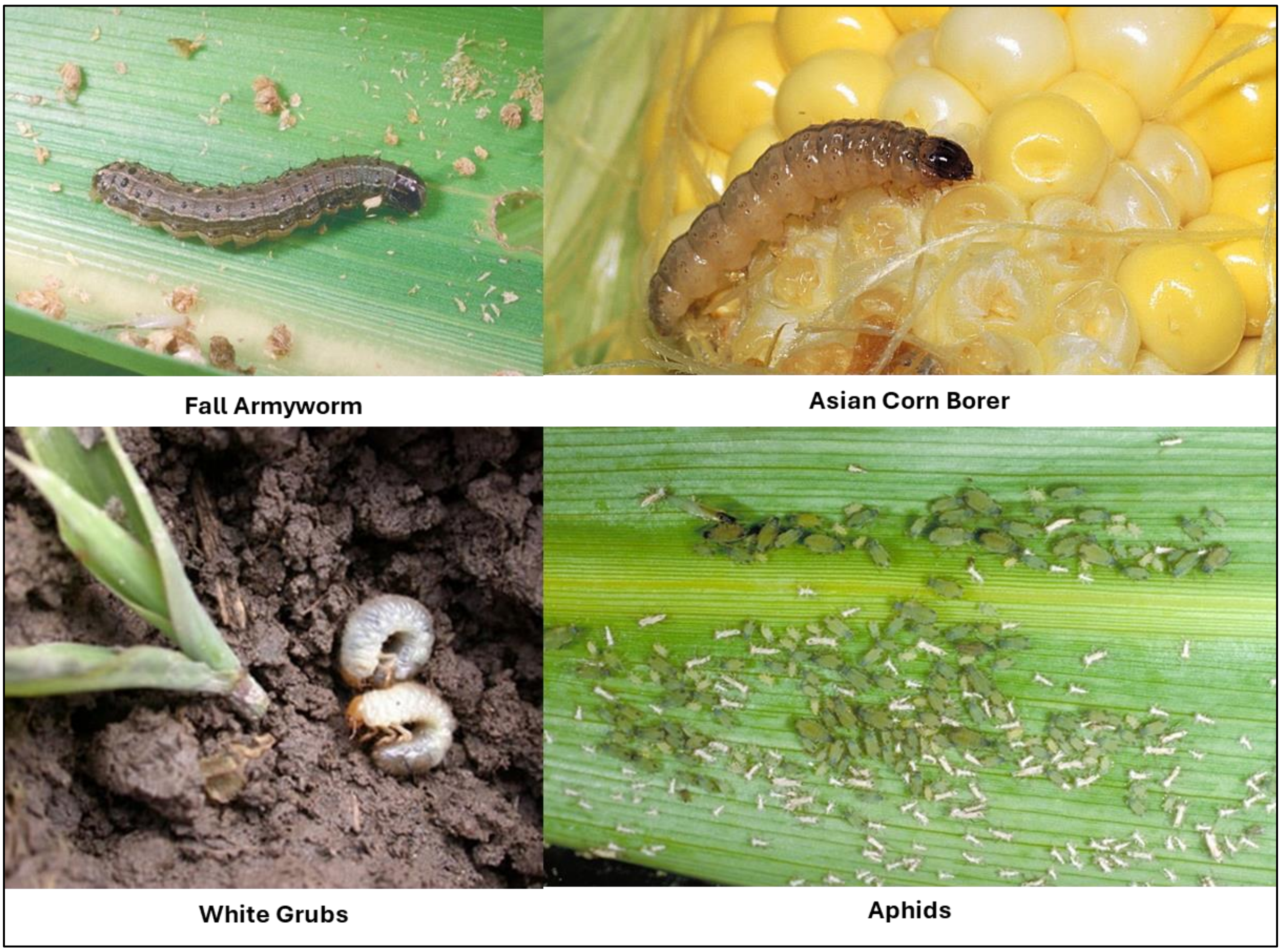


Figure 9: Most Common Pests of Seed Corn in Sri Lanka

Most Common Diseases in Sri Lanka

In Sri Lanka, Seed Corn is susceptible to several common diseases, which can significantly impact yield and quality. Here are some of the most prevalent diseases:

Disease	**Description**	**Damage**	**Management**
Gray Leaf Spot	Caused by the fungus *Cercospora zeae-maydis*, characterized by grayish lesions on leaves.	Reduces photosynthetic ability, leading to lower yields.	Use resistant varieties; apply fungicides; practice crop rotation and good sanitation.
Northern Corn Leaf Blight	Caused by the fungus *Exserohilum turcicum*, resulting in elongated lesions on leaves.	Can cause significant yield loss if not managed, especially in wet conditions.	Plant resistant hybrids; apply fungicides during early disease development; rotate crops.
Southern Corn Leaf Blight	Caused by *Bipolaris maydis*, leading to large, tan lesions on leaves.	Affects leaf area, resulting in reduced yield and quality.	Use resistant varieties; timely fungicide application; practice good field hygiene.
Corn Rusts	Includes *Puccinia sorghi* (Southern Rust) and *Puccinia sorghi-sorghi* (Common Rust).	Causes leaf discoloration, leading to reduced photosynthesis and yield loss.	Use resistant hybrids; apply fungicides; ensure good air circulation in crops.

Disease	Description	Damage	Management
Fusarium Ear Rot	Caused by *Fusarium spp.*, affecting ears with white to pinkish mold.	Reduces grain quality and can produce mycotoxins harmful to livestock.	Use resistant varieties; practice crop rotation; ensure proper drying and storage of harvested corn.
Anthracnose	Caused by *Colletotrichum graminicola*, leading to dark lesions on leaves and stalks.	Can weaken plants and reduce yield, especially during wet conditions.	Use resistant varieties; apply fungicides if necessary; practice crop rotation.

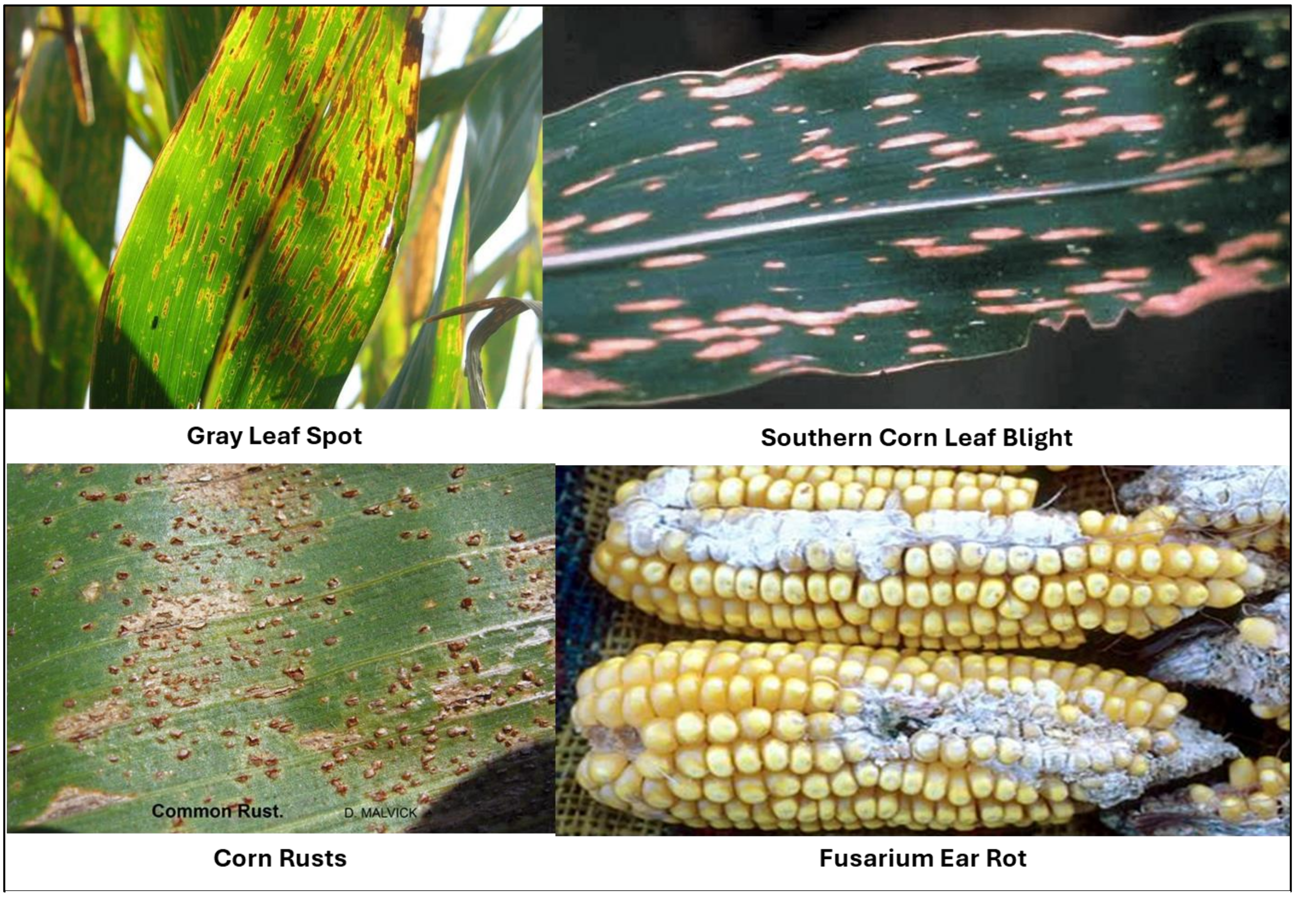


Figure 10: Most Common Diseases of Seed Corn in Sri Lanka

Chemical Control of Pests and Diseases

Chemical Control of Pests

Pest	Insecticide	Dosage	Management
Fall Armyworm	Chlorantraniliprole	0.5-1.0 L/ha	Apply at the first sign of infestation. Monitor fields weekly. Rotate with other classes of insecticides to reduce resistance.
Corn Borer	Lambda-cyhalothrin	0.2-0.5 L/ha	Use in rotation with other insecticides. Apply during early instar stages for best results. Scout regularly for signs of damage.
Armyworm	Bacillus thuringiensis (Bt)	1-2 kg/ha	Apply during early larval development. Can be combined with other management strategies like cultural controls to enhance effectiveness.
Thrips	Imidacloprid	0.15-0.3 L/ha	Monitor thrip populations closely; apply treatments when thresholds are met. Use in

Pest	Insecticide	Dosage	Management
			conjunction with beneficial insects where possible.
Aphids	Acetamiprid	0.1-0.2 L/ha	Treat when populations reach action thresholds. Scout fields frequently and consider integrated pest management (IPM) practices.
Whiteflies	Pyriproxyfen	0.3-0.5 L/ha	Monitor populations regularly and apply treatments as needed. Consider using reflective mulches to deter whiteflies.
Leafhoppers	Malathion	2-3 L/ha	Apply at the first sign of infestation. Rotate with other insecticides to minimize resistance development.
Rootworms	Fipronil	0.25-0.5 L/ha	Target applications to areas with high infestation risk. Integrate with crop rotation to manage long-term populations.
Spider Mites	Abamectin	0.2-0.4 L/ha	Apply during early infestation stages. Use miticides in rotation to prevent resistance buildup.
Cutworms	Chlorpyrifos	1-2 L/ha	Apply at planting or when larvae are detected. Monitor for re-infestation and consider cultural practices to reduce populations.

Chemical Control of Diseases

Disease	Chemical	Dosage	Management
Gray Leaf Spot	Azoxystrobin	0.5-1.0 L/ha	Apply at the first sign of symptoms; repeat every 14-21 days as needed. Rotate with other fungicides to prevent resistance.
Northern Corn Leaf Blight	Propiconazole	0.5-1.0 L/ha	Apply during early disease development; monitor weather conditions for optimal timing. Integrate with resistant varieties.
Fusarium Ear Rot	Carbendazim	0.5-1.0 L/ha	Treat seeds before planting; ensure good crop rotation to reduce pathogen load in the soil.
Southern Corn Leaf Blight	Tebuconazole	0.5-1.0 L/ha	Apply preventively during high-risk periods, especially in humid conditions. Combine with cultural practices.
Anthracnose	Chlorothalonil	1.0-2.0 L/ha	Monitor fields regularly; apply at the first sign of disease and continue at intervals during wet weather.
Downy Mildew	Metalaxyl	1.0-1.5 L/ha	Use as a seed treatment or foliar application; monitor humidity levels and apply preventively.
Pythium Root Rot	Mefenoxam	0.25-0.5 L/ha	Apply as a seed treatment or in-furrow application at planting. Ensure good drainage to minimize disease risk.
Bacterial Leaf Blight	Copper-based fungicides	2.0-3.0 kg/ha	Apply preventively during wet conditions; ensure thorough coverage of the foliage. Rotate with non-copper options to prevent resistance.

Disease	Chemical	Dosage	Management
Sclerotinia Stalk Rot	Boscalid + Pyraclostrobin	1.0-1.5 L/ha	Apply during flowering; monitor for conditions conducive to disease development and apply as needed.
Root and Stalk Rot	Trichoderma spp.	1-2 kg/ha	Apply as a soil amendment or drench; promotes beneficial microbial activity to outcompete pathogens.

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.

CROSS POLLINATION

Cross-pollination of seed corn involves several key steps and timing considerations that are critical for achieving successful pollination and seed production. Here's an overview of the process:

1. Flower Development
    a. Tassel Formation: Corn plants develop tassels (the male flower) at the top of the plant 6 to 8 weeks after planting. Tassels typically emerge first, around 2-3 weeks before the silks appear.
    b. Silk Emergence: The ears (female flowers) develop later, with silks emerging from the ear shoots. This usually occurs about 1-2 weeks after tassel formation (8 to 10 weeks after planting).
2. Timing of Pollination
    a. Tassel Shedding: The pollen is released from the tassels in a process called anthesis, which usually occurs in the early morning. This is a critical time for pollen viability.
    b. Silk Reception: Silks typically emerge about 1 to 2 weeks after tassel shedding. Each silk corresponds to a kernel and is receptive to pollen for about 10-14 days.
    c. Optimal Pollination Window: The best conditions for pollination occur when the silks are fresh, and the tassels are shedding pollen simultaneously. This is often during warm, dry weather (10 to 12 weeks after planting).
3. Duration of Events
    a. Pollen Viability: Pollen can remain viable for a few hours to a couple of days once shed, depending on environmental conditions (humidity, temperature).
    b. Silk Longevity: Silks can remain receptive for several days but must receive pollen within their receptivity period to fertilize and develop kernels.
    c. Pollination Process: Cross-pollination occurs when wind or insects carry pollen from the tassel to the silk. This can happen quickly if conditions are favorable.
4. Post-Pollination
    a. After successful pollination, fertilization occurs, leading to kernel development, which can take several weeks (12 to 16 weeks after planting).
    b. The entire process from tassel emergence to kernel formation can span several weeks, with harvest typically occurring 2-3 months after pollination.

DETASSELING OF SEED CORN

Detasseling is a crucial practice in seed corn production, primarily aimed at producing hybrid seeds. It involves removing the tassels from female plants to prevent self-pollination and ensure cross-pollination with male plants. This is typically done when the tassels are just beginning to shed pollen.

Timing

1. Growth Stage: Detasseling typically occurs when the corn plants reach the tasseling stage, usually around 8 to 10 weeks after planting. This is when the plants have grown tall enough to have developed visible tassels before they begin to shed pollen.
2. Optimal Window: The ideal time for detasseling is early in the morning or late in the afternoon when temperatures are cooler, as this reduces stress on the plants and improves the workers' effectiveness.

Figure 11: Machine or Mechanical Detasselling

Best Procedures

1. Preparation:
a. Ensure you have the right tools, such as sharp knives or detasseling machines.
b. Train workers on how to properly identify the tassels and the technique for removing them without damaging the plant.
2. Manual Detasseling:
a. Technique: Workers should grasp the tassel firmly and pull it out with a twisting motion to avoid breaking the plant.
b. Coverage: Each row should be systematically covered to ensure all plants are detasseled, with workers moving in an organized manner to maintain efficiency.

Figure 12: Manual Detaseling

3. Mechanical Detasseling:
   a. Equipment: Use specialized detasseling machines that can efficiently remove tassels from multiple plants in a single pass.
   b. Calibration: Ensure machines are properly calibrated for the height and spacing of the corn plants.
4. Post-Detasseling Care:
   a. Monitor the fields for any missed tassels and conduct a follow-up detasseling if necessary.
   b. Assess the health of the plants post-detasseling to ensure they are recovering well from the process.
5. Timing of Pollination:
   a. After detasseling, it is crucial to monitor the pollination stage, as the timing of pollen release from the neighboring male rows will affect hybrid seed formation.

Detasseling is a labor-intensive but vital practice in producing high-quality seed corn. Proper timing and techniques, whether manual or mechanical, are essential to ensure minimal damage to plants and maximize hybrid seed yield.

BENDING THE CORN EAR TO REDUCE THE MOISTURE CONTENT BEFORE HARVESTING

Bending the corn ear, also known as "ear flexing," is a very simple technique used to reduce moisture content in corn before harvesting. This method helps to facilitate earlier harvesting and improve grain quality:

1. Timing: The technique is typically applied once the corn kernels are fully mature but before the moisture content reaches the ideal level for harvesting. This usually occurs when the kernels are at the dough stage or early dent stage.
2. Bending Process: Farmers gently bend the ear of corn back towards the stalk. This action can help to break the connection between the ear and the plant, allowing moisture to escape more easily. When the plant has only one ear, the whole plant can be bent

Figure 13: Bending the Corn Ear

3. Exposure to Air: By bending the ear, it increases the ear's exposure to air circulation. Improved airflow around the kernels aids in the drying process, as more moisture can evaporate from the surface of the kernels.
4. Reducing Moisture Content: The goal is to facilitate a drop in moisture content to the desired level (typically around 15-20% for safe storage). This can help prevent spoilage and reduce the risk of mold.
5. Monitoring: After bending, it's important to monitor the moisture levels regularly. This ensures that the corn is harvested at the right time to maximize quality and minimize losses.

This technique is particularly useful in regions with high humidity or where weather conditions may delay harvesting.

HARVESTING SEED CORN

Seed corn harvest timing is crucial for optimal seed quality. The following features of the harvesting practice will ensure optimum productivity and seed quality:

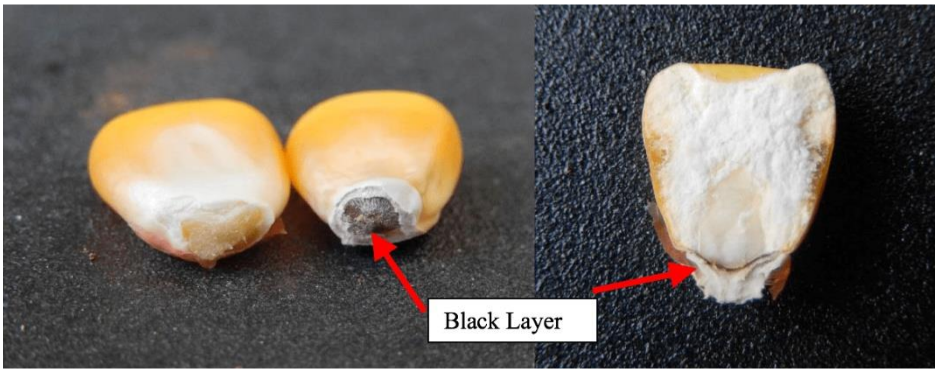


Figure 14: Black Layer Formation

1. Internal Signs of Maturity:
   a. Black Layer Formation: The most critical internal sign. A black layer develops at the kernel base, indicating physiological maturity and maximum dry matter accumulation.
   b. Kernel Hardness: Kernels should be hard and dent-resistant when pressed with a fingernail.

2. External Signs of Maturity:
    a. Husk Color: Husks transition from green to brown and become papery.
    b. Stalk Condition: Stalks and leaves begin to dry down and turn brown.
    c. Silks: Silks become dry and brown.
3. Moisture Content:
    a. Ideal moisture content for seed corn harvest is typically around 25-30%.
    b. Higher moisture can lead to mold and fungal growth during storage.
    c. Lower moisture can increase kernel breakage during handling and processing.

Figure 15: External Signs for Proper Harvesting

Harvesting:

1. Timing: Harvest should occur after the black layer has formed and kernel moisture content is within the optimal range (25% to 30%).
2. Methods: Combine harvesters are typically used for large-scale seed corn production.
3. Handling: Careful handling is essential to minimize kernel damage.

POST-HARVEST HANDLING OF SEED CORN

Proper post-harvest handling is crucial for maintaining seed viability and quality. Here's a breakdown of key steps and considerations:

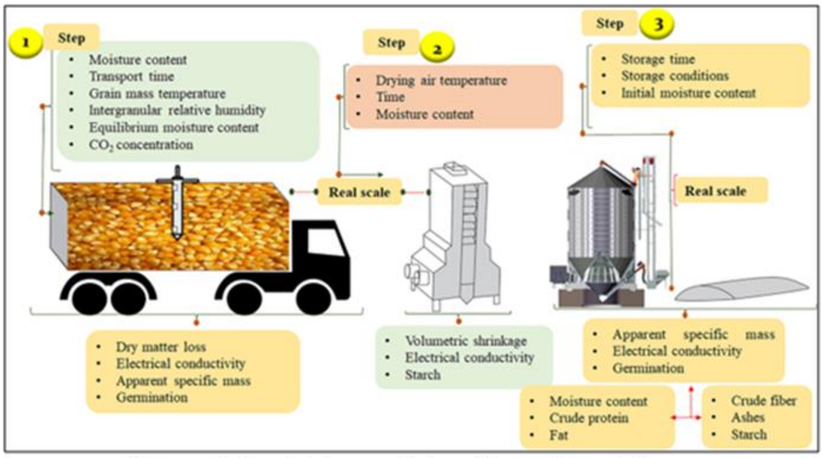


Figure 1: Post-Harvest Handling of Seed Corn

1. Drying
    a. Importance: Drying is the most critical step to prevent mold, insect infestation, and germination during storage.
    b. Methods:
        I. Natural Air Drying: Suitable in dry climates with good air circulation. Can take several weeks.
        II. Forced-Air Drying: More efficient, using fans to accelerate drying. Requires specialized equipment.
        III. Moisture Content: Target moisture content for long-term storage is typically 13-15%.

2. Cleaning and Grading
    a. Cleaning: Removes foreign material (e.g., leaves, stems, dirt) and damaged kernels.
    b. Grading: Separates seeds based on size, shape, and quality to ensure uniformity.

3. Treatment

a. Insecticide Treatment: Protects seeds from insect damage during storage and planting.
b. Fungicide Treatment: Controls fungal diseases that can reduce seed viability.

4. Storage
    a. Conditions:
        I. Cool and Dry: Ideal temperature is around 40-50°F (4-10°C) with low humidity (30-50%).
        II. Well-Ventilated: Adequate air circulation helps prevent moisture buildup and mold growth.
        III. Protected from Pests: Store in sealed containers or bins to prevent insect infestation.
    b. Time Frames:
        I. Short-Term Storage: Up to 6 months under optimal conditions.
        II. Long-Term Storage: May require specialized storage facilities and techniques for longer periods.

5. Seed Testing
    a. Regular Testing: Periodically test seed germination rates and vigor to ensure quality.

6. Packaging and Labeling
    a. Packaging: Use appropriate packaging materials to protect seeds from moisture and damage.
    b. Labeling: Clearly label seed bags with variety, planting date, and any treatments applied.

ANNEX 1: SOIL TEST RESULTS AND FERTILIZER RECOMMENDATIONS

Maize Ampara

Report No.	**CIC/0040/24-25**
	Hybrid Maize Seeds Production Cluster in Ampara District (Siyambalawewa Area)

Results

Sample Code	Lab No.	pH	OM	EC	Ca	Mg	K	N	P	S	Cu	Fe	Mn	Zn	B	CEC	Ca/Mg	Ca/K	Mg/K	Ca+MG/K	Ca Sat
		1:2.5, H_2O	%	µS/cm	Exchangeable (meq/100g)			Total (%)	Available (ppm)							cmol/Kg	Cation Ratios				
Sample - 01	W8 498	6.28	0.67	110.1	2.07	1.25	0.60	0.22	10.0	12.0	1.6	57.4	10.2	1.5	0.05	3.9	2.1	5.7	2.7	8.4	31.9

Interpretation:
- Low Organic Matter
- Low P
- Low K
- Low Micronutrients specially S, Cu and Zn
- Low CEC and Cation Ratios
- Ca Saturation very low

Fertilizers Required:
- Urea
- TSP
- MOP
- MgSO4 as a source of S
- CaSO4 at land preparation
- Foliar Micronutrients

Irrigation and Fertigation Farmer's Guide

Per Plot Per Application

			Irrigation		Kg/Application				ml	
Week	**Growth Face**	**Phenology**	**Hours**	**Minutes**	**Urea**	**TSP**	**MOP**	**MgSO4**	**Phosphoric Acid (ml)**	**Micronutrients**
1	Emergence	Germination	0	23	0.4	1.8	1.1	3.9		Foliar
2		Germination	0	23	0.4	1.8	1.1	3.9	101	Foliar
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16		Maturation	0	44	0.4	1.2	0.8	2.6	101	Foliar

Two Applications per Week Except Phosphoric Acid Every Two Weeks

Incorporate CaSO4 at land preparation after Compost and before the 2nd ploughing at a rate of 250 Kg/Plot

Maize for Seed Vavuniya

PH	OM	EC	Ca	Mg	K	NH4 - N	P	S	Cu	Fe	Mn	Zn	CEC	Ca/Mg	Ca/K	Mg/K	Ca+MG/K	Ca Sat
1:2.5, H2O	%	S/cm	Exchangeable (meq/100g)			Available (ppm)							Cmol/kg	Cation Ratios				
6.9	1.3	225.0	8.7	3.5	1.8	33.9	29.0	16.0	11.7	238.0	82.0	5.4	14.0	2.5	4.9	2.0	6.9	62.0
6.9	2.7	274.0	11.9	4.4	1.0	31.6	41.0	42.0	8.2	322.0	226.0	5.0	17.2	2.7	12.3	4.5	16.9	69.0
6.8	1.3	112.6	5.8	2.2	1.1	43.1	70.0	21.0	4.4	438.0	148.0	2.6	9.1	2.7	5.2	1.9	7.1	64.0
6.9	2.2	504.0	7.5	2.7	4.5	50.6	23.0	52.0	5.1	358.0	144.0	2.3	14.7	2.8	1.6	0.6	2.2	51.0
8.0	1.3	344.0	13.3	4.7	0.5	28.9	16.0	26.0	7.3	238.0	116.0	9.4	18.5	2.8	25.5	9.0	34.5	71.9
7.2	1.5	189.1	8.5	3.1	1.1	38.5	20.0	28.0	4.5	370.0	126.0	2.5	12.7	2.7	8.1	3.0	11.0	67.1
6.5	1.2	555.0	6.6	2.8	1.5	55.6	66.0	26.0	5.0	660.0	148.0	2.0	10.8	2.4	4.5	1.9	6.4	60.9
7.2	1.8	247.0	8.8	3.8	1.3	28.2	288.0	22.0	10.4	200.0	76.0	5.1	13.9	2.3	7.0	3.1	10.1	63.5
7.4	1.2	177.5	7.5	3.8	0.7	29.5	54.0	32.0	6.9	564.0	146.0	4.5	12.7	2.0	10.3	5.2	15.5	59.4
7.3	1.2	258.0	10.8	4.5	0.8	27.5	42.0	37.0	6.8	362.0	96.0	2.5	16.2	2.4	13.2	5.5	18.7	66.9
7.1	1.3	344.0	7.0	2.7	4.9	56.2	33.0	107.0	5.2	534.0	142.0	1.7	14.6	2.6	1.4	0.6	2.0	47.9
7.0	2.2	809.0	11.4	4.8	1.5	31.6	19.0	22.0	7.8	194.0	84.0	4.7	17.7	2.4	7.6	3.2	10.8	64.5
7.8	1.3	160.2	11.7	4.8	0.5	20.6	22.0	51.0	4.3	358.0	98.0	2.5	17.0	2.4	23.8	9.9	33.7	68.6
7.3	1.5	207.0	8.0	2.4	1.2	26.9	144.0	24.0	6.2	854.0	136.0	3.7	11.6	3.3	6.8	2.1	8.8	69.0
7.3	1.6	210.0	9.1	3.4	1.0	26.2	86.0	14.0	5.6	448.0	146.0	2.7	13.5	2.7	9.1	3.4	12.5	67.4
7.2	1.6	307.8	9.1	3.6	1.6	35.3	63.5	34.7	6.6	409.2	127.6	3.8	14.3	2.5	5.9	2.3	8.2	63.8

Interpretation:
Low Organic Matter
Low K in a portion of samples
Low Micronutrients specially S, Cu and Zn

Fertilizers Required:
Urea
MOP
MgSO4 for S
Foliar Micronutrients

Irrigation and Fertigation Farmer's Guide

Per Plot Per Application

			Irrigation		Kg/Application			ml	
Week	**Growth Face**	**Phenology**	**Hours**	**Minutes**	**Urea**	**MOP**	**MgSO4**	**Phosphoric Acid (ml)**	**Micronutrients**
1	Emergence	Germination	0	23	0.4	1.1	3.9		Foliar
2		Germination	0	23	0.4	1.1	3.9	101	Foliar
3		Seedling Development	0	23	1.2	1.1	3.9		Foliar
4		Seedling Development	0	23	1.2	1.1	3.9	101	Foliar
5	Development	Vegetative Growth	0	38	1.5	0.8	2.7		Foliar
6		Vegetative Growth	0	38	1.5	0.8	2.7	101	Foliar
7		Vegetative Growth	0	38	1.5	0.8	2.7		Foliar
8		Vegetative Growth	0	38	1.5	0.8	2.7	101	Foliar
9		Tasseling	0	38	2.7	0.8	2.7		Foliar
10		Tasseling	0	38	2.7	0.8	2.7	101	Foliar
11	Maturity	Kernel Fill	0	44	1.2	0.8	2.6		Foliar
12		Kernel Fill	0	44	1.2	0.8	2.6	101	Foliar
13		Kernel Fill	0	44	1.2	0.8	2.6		Foliar
14		Kernel Fill	0	44	1.2	0.8	2.6	101	Foliar
15		Maturation	0	44	0.4	0.8	2.6		Foliar
16		Maturation	0	44	0.4	0.8	2.6	101	Foliar

Two Applications per Week Except Phosphoric Acid Every Two Weeks

ANNEX 2: 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.