



NAANDANJAIN
Irrigation

CORN (MAIZE) & BIOFUEL CORN

NaanDanJain has many years' experience with corn irrigation. Modern irrigation can increase the productivity of the crop for higher yields, using less water and fertilizers.

Corn is one of the crops that can be used for biofuel production. The economic considerations of biofuel farming can be justified by adopting advanced irrigation technology.

The following information will help you to maximize corn yields and income.

Maize is a grain that was first grown by the indigenous peoples of Central America in prehistoric times.

Today maize is the most widely cultivated crop in the world, followed by rice and wheat.

The United States produces about 50% of the world's maize harvest; while other top producing countries are India, Brazil, Mexico, France and Argentina.

Maize may be consumed as food or used for the production of flour, starch, oil, biofuel, feed for livestock, etc.

Maize is an annual summer crop. It is usually planted at the end of winter and harvested during the summer, although in certain regions it is grown all year round. The crop requires a warm climate and constant, reliable irrigation.

The growing period is 75-80 days when grown for kernels and 110-115 days when grown for silage.

Average yields are dependant on many parameters, such as the maize species, the region in which it is grown, and the timing of planting. Yields may vary from 15 to 25 tons/ha of cobs (10 to 12 tons/ha of kernels).

When grown for fodder, yields may reach 20 to 30 tons/ha, as dry matter.



SOIL

Crop rotation must be considered when choosing the location of the field for maize cultivation. Maize can follow any other crop, except maize and sorghum. It is not advisable to cultivate maize on the same plot at intervals of less than 3 years. When maize is cultivated at shorter intervals (e.g. every year), there is a constant need to combat soil diseases and replenish soil minerals.

The maize root system is well-developed and requires deep, non-compacted soil for proper plant development.

PLANTING

Minimum temperature for germination: 8°C, emergence after 16-20 days.

Optimum temperature for germination: 20°C, emergence after 5-6 days.

Desired plant density to achieve maximal yields: 65,000–80,000 plants per hectare.

Plant density should be lowered to 50,000–70,000 plants per hectare when the growing season extends into the winter.

This is done in order to achieve thicker stalks, which are more wind and rain resistant, during the season.

When grown for silage, plant density may be increased to as high as 120,000 plants per hectare.

It is common practice to plant two rows of maize on one growing bed. The rows should be planted 75–100 cm apart.

The planting depth should be 3 cm when the soil temperatures are low and 5-6 cm when the temperatures are high.



IRRIGATION:

- When corn is grown intensively, it is quite sensitive to any water deficits imposed during vegetative growth. This can be results in a lessened photosynthetic process and reduced root system.
- Water deficits imposed during silking and tasseling are most detrimental to corn yields. Stresses during reproductive growth often result in increased leaf senescence and a reduction in both the rate and duration of seed filling.
- Efficient water management is important in order to achieve higher yields.
- Under varying climatic conditions, high and stable corn yields are achieved only through efficient irrigation.

YIELD LOSS DUE TO WATER STRESS

Growth stage	Yield loss per day caused by stress %
Seedling to 4 leaf	-
4 leaf to 8 leaf	-
8 leaf to 12 leaf	-
12 leaf to 16 leaf	3.0
16 leaf to tasseling	3.2
Pollination (R1)	6.8
Blister (R2)	4.2
Milk (R3)	4.2
Dough (R4)	4.0
Dent (R5)	3.0
Maturity (R6)	0

Source: Rhoads and Bennett (1990) and Shaw (1988)

SOIL PROFILE FILLING AND GERMINATION

- Before planting maize, the soil moisture level must be kept at field capacity, up to a depth of 1.2 m.
- A continuous supply of moisture must be maintained along all soil layers during the sprouting and rooting periods. This can be controlled via proper irrigation during these periods. Insufficient irrigation will result in the poor establishment of the seminal & supporting roots system (nodal roots), increasing the probability of plant lying down .
- The maize root system is adversely affected by high soil temperatures, salinity and compactness, low levels of soil moisture and lack of potassium. If these poor conditions are prevalent, the maize yields will eventually be affected.

CROP FACTOR VS. PLANT DEVELOPMENT

Crop stage	Time	Crop factor
Emergence till differentiation	25–30 days from emergence	0.4–0.6
Until full tasseling	30–50 days from emergence	0.7–0.9
Until silking and pollination	6–10 days from full tasseling	0.9–1.0
Kernel development until milk	15–20 days from pollination	0.8–0.7

Average water requirement for one crop is 400–700 mm.

SPECIAL ADDITIONAL IRRIGATION FOR SOWING IN DRY SOIL:

1. Germination: 350–450 m³/ha
2. Rooting—stage 1 (4 days after germination): 350–450 m³/ha
3. Rooting—stage 2 (10 days after rooting 1): 350–450 m³/ha

DRIP IRRIGATION IN CORN

The most effective method of irrigating corn with the greatest benefits:

- Better uniformity
- Better irrigation efficiency - saving water and fertilizers
- Lower operating pressure and energy
- Saving labor
- Reduction of foliar diseases
- Usage of the system during all hours of the day - no wind influence
- Better uniformity and less water waste in plot edges
- Higher yields (10–20%), mainly due to uniformity and efficient fertilization



DESIGN DRIPLINE

The common dripline design is one lateral for two rows of crop. Recommended dripper spacing is 50 cm–75 cm with dripper flow rate 1–2.2 l/h.

IRRIGATION SYSTEMS COMPARISON

	Center pivots	Hose reels (Gun sprinklers)	Furrow irrigation	Drip systems
Precipitation rate (mm/hr)	60–70	30–40	No standard definition	2.0-4.5
Operating pressure (bar)	4-5	6–8	Gravity	2–3.5
Energy efficiency	Average	Very low	High	High, (with up to 40% water saving vs. hose reels)
Water efficiency	Good 70–85%	Low 60–70%	Poor 50%	High–95% (with up to 30% water saving vs. hose reels)
Sensitivity to wind	Medium	High	None	Not relevant
Soil crust (clay texture)	Medium-high risk	High risk	High risk	None
Fertilizer application	Moderate efficiency	Low efficiency	Not practical	Recommended with successful results
Aeration status	Poor	Poor	Poor	Good
Water run-off	Yes	Yes	Yes	No
Sensitivity to disease	High	High	Low	Low
Environment-friendly	No	No	No	Yes
Crop quantity/quality	Good	Moderate	Moderate	Very good
Return on investment	Moderate	Good	Moderate	Very good

FERTILIZATION

Corn is a heavy consumer of nutrients. Sufficient fertilization will ensure the quality and quantity of the crop.

Corn fertilization should be based on soil tests.

Crop requirement: Nutrient removal kg/ha

Nitrogen (N) kg/ha	Phosphorus (P ₂ O ₅) kg/ha	Potassium (K ₂ O) kg/ha
350	150-220	400-500

Fertilizers to be applied:

	Nitrogen (N) kg/ha	Phosphorus (P ₂ O ₅) kg/ha	Potassium (K ₂ O) kg/ha
Base fertilization*	80-120	100-125	200-250
Until tasseling	175–225	50–75	100–150



NAANDANJAIN SOLUTIONS FOR CORN IRRIGATION

NaanDanJain provides a wide range of solutions for drip irrigation of corn. These range from thin-walled dripline (for seasonal use) to thick-walled dripline (for multi-seasonal use), PC and non - PC drippers.

Installation may be done above surface or subsurface. Our system is fully mechanized for laying and retrieval.



Hydraulic retrieving machine ,2.0m reel

THIN-WALLED DRIPLINE

Thin-walled dripline system for seasonal use, providing maximum performance at minimum cost. Excellent for biofuel crops at low energy requirement and efficient irrigation. Can be used on the surface or shallow subsurface.

TalDrip

Innovative thin-walled, multi-purpose dripline with the most advanced labyrinth dripper on the market. Provides maximum durability, accuracy and clog resistance.

Wall thickness: 10–25 mil

Diameter: 16–23 mm Flow rate: 0.6, 1.0, 1.7 l/h



MULTI-SEASONAL MECHANIZED SYSTEM

This retrieval and storage system facilitates easy laying out and collection of the dripline. For long-term use of medium-walled or heavy-walled dripline, PC and non-PC. Rolling can be done on a small cardboard reel or a large metal reel, according to dripline type and customer requirements, with suitable machinery for rolling up and laying out.



Three reels laying machine, 13000-20,000m

AmnonDrip

Thick-walled, pressure-compensating, flat dripline for maximum accuracy at variable topography and long laterals. The integrated Cascade labyrinth provides strong self-cleaning turbulence with the best clog resistance in the market. Wall thickness: 0.63–1.2 mm (25–45 mil) Diameter: 16–23 mm Flow rate: 1.1, 1.6, 2.2 l/h



Naan PC

Heavy-duty, pressure-compensating cylindrical dripper for maximum accuracy in variable topography and long laterals for multiple uses. Excellent for rolling, due to the cylindrical structure of the pipe. Wall thickness: 0.9–1.2 mm (35 – 45 mil) Diameter: 16–20 mm Flow rate: 0.9, 1.1, 1.6, 2.2 l/h



SUBSURFACE DRIP SYSTEM (SDI)

A great solution for water saving, protection from animal and bird damage and increased fertilization benefits. It also keeps the top soil dry and reduces diseases and weeds. Prevents the need for constant installation and retrieval of the drip system, season after season. Methodical implementation and operation is recommended.



AmnonDrip (Anti-Siphon PC)

Special NaanDanJain dripper for subsurface drip irrigation, with pressure-compensating anti-siphon design to prevent suction at the draining stage. Wall thickness: 0.63–1.2 mm (25–45 mil) Diameter 16–23 mm Flow rate: 1.1, 1.6, 2.2 l/h



LAY FLAT SYSTEM

NaanDanJain has a wide range of lay flat hose for more flexibility and quick installation in the field. The lay flat pipe can be used as a main pipe or as a submain pipe. This mobile system can be storied conveniently and efficiently and it lasts for many years.



THE BOTTOM LINE

By adopting NDJ solutions, you will increase production with lower expenses in the long run.

Contact our office for design and quotation.



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NaanDanJain is committed to finding the ideal solution for your corn crop, tailored to your local climatic conditions, soil and water properties and budget. Contact our office or your local dealer for further information.

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All information should be used only as a guideline.
For specific recommendations contact your local agronomist.

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