



SUGAR CANE

BACKGROUND

The sugar cane is a perennial tropical grass with shallow fibrous root system .

Plant (first) crop is normally followed by 2 to 4 ratoon crops, and in certain cases up to a maximum of 7 crops are taken (in Latin America).

A ratoon is the cane that grows from buds remaining in the stubble left in the ground after a crop has been harvested.

It's grown for the sugar mainly but today ethyl alcohol (Biofuel) production is widely spreading, molasses and fiber (bagasse) are by products.

Sugar cane can be grouped into three varieties: early, mid-late and late.

It is propagated vegetatively by planting stem cutting (setts) from which axillary buds grow to produce stalks (main stem). Secondary and tertiary stalks (tillers) are produced at the base of the primary stalk.

Sugar cane irrigation is by furrow, sprinklers and drip methods.

The drip system already started at the 70th of the 20 century, in Hawaii and today its spread in all the growing areas, contribute to higher yields and with improved efficiency.

Good yield are in the range of 100-160 ton ha while in India maximal commercial results reaching already 250-300 ton/ha by introduction of the new management concept by Jain.

Sugar cane is grown in more than a hundred countries under temperate, subtropical and tropical conditions.



Top ten sugarcane producers

Country	Production (tons)
Brazil	672,157,000
India	285,029,000
China	116,251,272
Thailand	66,816,400
Pakistan	50,045,400
Mexico	49,492,700
Colombia	38,500,000
Philippines	32,500,000
Australia	30,284,000
Argentina	29,000,000

CLIMATE

The yields affected significantly by temperature, relative humidity and solar radiation.

Optimum temperature for sprouting (germination) of stem cuttings is 32 to 38°C. Optimum growth is achieved with mean daily temperatures between 22 and 30°C. Minimum temperature for active growth is approximately 20°C.

For ripening, however, relatively lower temperatures in the range of 20 to 10°C are desirable, since this has a noticeable influence on the reduction of vegetative growth rate and the enrichment of sucrose in the cane. A long growing season is essential for high yields.

The normal length of the total growing period varies between 9 months with harvest before winter frost to 24 months in Hawaii, but it is generally 15 to 16 months. The flowering of sugarcane is controlled by day length, but it is also influenced by water and nitrogen supply. Flowering has a progressive deleterious effect on sucrose content. Normally, therefore, flowering is prevented or non-flowering varieties are used.

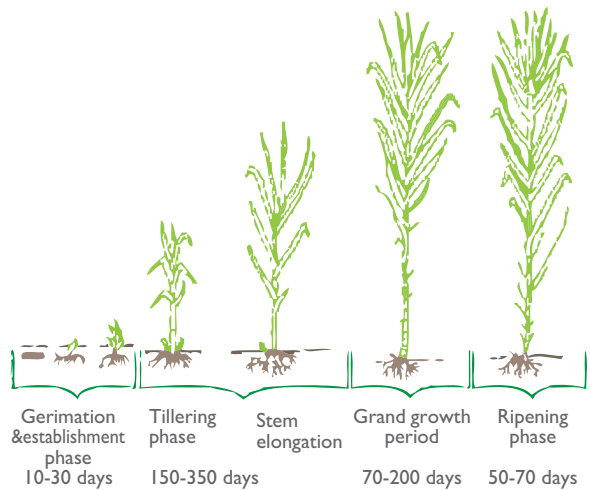
Stalk growth increases when daylight is in the range of 10 – 14 hours.

GROWTH STAGES

There are four growth stages:

- Germination and emergence
- Tillering and canopy establishment
- Grand growth (120-270 days after planting)
- Ripening

Each stage will have specific water and fertilizers requirements



after Kuyper, 1952

SOIL

Sugar cane requires a well-drained, aerated soil.

Compacted soils affect root penetration, water and nutrient uptake. Suitable soil pH range between 5.0-8.5 with optimal of 6.5.

Sugarcane is moderately sensitive to salinity .

Decrease in crop yield due to increasing salinity is:

Salinity levels (mmhos/cm)	Crop decrease (%)
Up to 1.7	0
3.3	10
6.0	25

PLANTING PATTERN

The planting pattern is single row or double row according to local practice, soil, climate and variety. With mechanical harvesting a single row pattern is common. Planting depth is generally 10-15cm. The crop is grown by vegetative propagation and requires 40,000 two-bud or 30,000 three-bud sets per hectare in order to maintain desired millable tillers.

Stalk population target of 130,000 ha for high yields. Recent results of Jain in India achieve higher yields with planting of 62,000 two-bud, at 165cm row spacing, results with 150,000 tillers and 250 ton /ha

Double (paired) row

Two common spacing are 120-150cm (pairs center to center) x 45cm in between the pair and 200x 70 cm, (other combination are exist).

The pair to pair spacing depends on soil fertility; higher the fertility wider the spacing.

Other consideration is the cost of the drip system.



Double (paired) row

Single row spacing

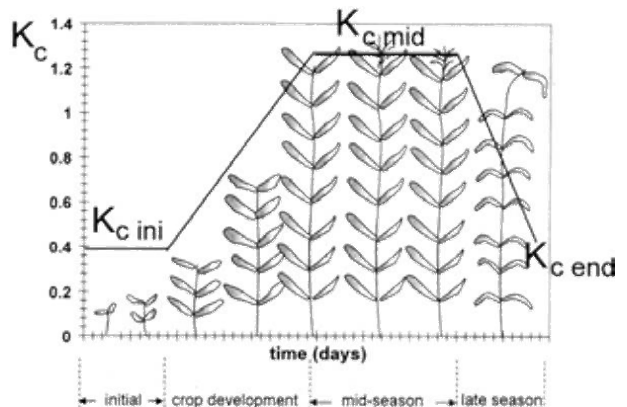
90 to 150 cm between rows



WATER

For high yields, the seasonal crop water requirements are in the range of 1100 to 1500 mm according to climatic conditions and varying lengths of growing seasons (12 – 14 months), with a daily evapotranspiration rate of 4 to 7 mm/day.

General curve of crop water requirement



The crop coefficient (kc) values, for different growth of stages

Development stages	Days	Kc coefficient*
Planting to 0.25 full canopy	30-60	0.45-0.6
0.25 to 0.50 full canopy	30-40	0.75-0.85
0.50 to 0.75 full canopy	15-25	0.90-1.00
0.75 to full canopy	45-55	1.00-1.20
Peak use	180-330	1.05-1.30
Early senescence	30-150	0.80-1.05
Ripening	30-60	0.60-0.75

* Source FAO publication

To calculate the daily water requirement multiple the daily ET by the relevant Kc.

Tensiometers guide line

The Tensiometer (moisture sensor in the soil) can assist in the decision when to irrigate and can control accesses of watering.

Installation depth: 20cm

Moisture tension trigger for irrigation:

15 – 25 centibars at tillering and grand growth

60 centibars at ripening period

FERTILIZATION

Sugar cane is a heavy consumer of nutrients. Its root system is shallow and fibrous, therefore, fertigation is recommended for higher nutrient availability and use efficiency. The aim of the fertigation program is to supply the nutrients required by the sugar cane on time and to minimize losses due to leached nitrate.

Fertilizers program

It is always preferable to take soil analysis, before the season, to preform optimal fertilizers program.

If it's not available, use the recommended table

(For ratoon crops increased quantities by 25% to maintain higher yields)

Nitrogen (N)	Phosphorus (P ₂ O ₅)	Potassium (K ₂ O)
250–300 kg/ha	80–100 kg/ha	125–250 kg/ha

Basal application N will be about 80 kg/ha at the time of land preparation before planting.

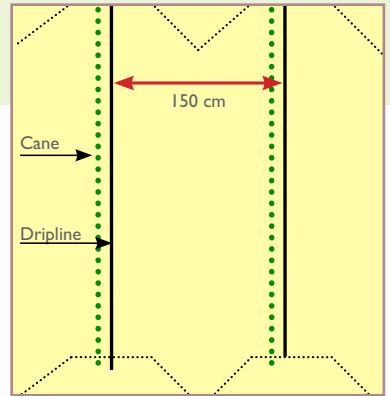
Farm manure in the rate of 12.5 ton/ha is recommended

Fertilizers (kg/ha) Vs. growth stage

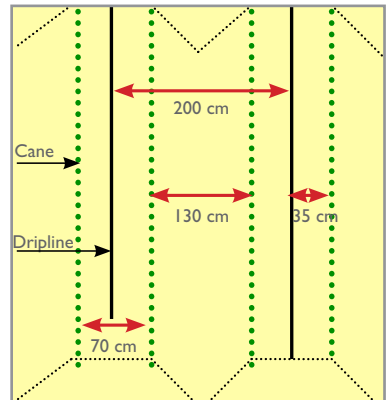
Growth period	Nitrogen (N)	Phosphorus (P ₂ O ₅)	Potassium (K ₂ O)
Emergence and establishment	30	25	
Tillering			
Formative phase I	40	35	50
Formative phase II	100	25	10
Grand growth I	80	15	20
Grand growth II			40
Grand growth III			50
Total	250	100	170



Fertilizers tank center at the Head control



Single row method - one per row



Double row method - one lateral per two rows

DRIP SYSTEM

Drip irrigation around the globe enable to double the yields while saving 20-40% water, 30% fertilizers compare to furrow irrigation. Furthermore, drip irrigation accounts for the improvement in sucrose content compared to conventional furrow and overhead sprinkler irrigation .

Drip system design

The drip system can be above surface or as sub-surface (SDI). The SDI is gaining more popularity as it is more suitable for ratoon crop and modern harvesting.

Dripper spacing

According to soil structure:

Sandy soil - 30 cm

Loamy medium soil – 40-50 cm

Clay heavy soil - 60-70cm

Dripper flow rate 1-2.2 l/h



NAANDANJAIN RANGE OF SOLUTIONS

DRIP PRODUCTS

A special drippers models for sugarcane application (subsurface up to 7 years) that designed by NaanDanJain include Turbulent non PC and PC Anti Syphon (AS) drippers. Integrated Cascade labyrinth provides strong self-cleaning turbulence with excellent clog resistance features.

TalDrip

Thin wall dripline, highly efficient, accurate low energy product.
Diameter 16-23mm, Flow rate 0.6, 1.0, 1.7 l/hr

Top Drip PC&AS

Thin & medium wall thickness, highly efficient self cleaning dripline.
Diameter - 16-22mm, flow rate- 1.0, 1.6 l/hr

Anti-Syphon(AS) model is recommended for SDI system



TalDrip model



TopDrip PC AS model

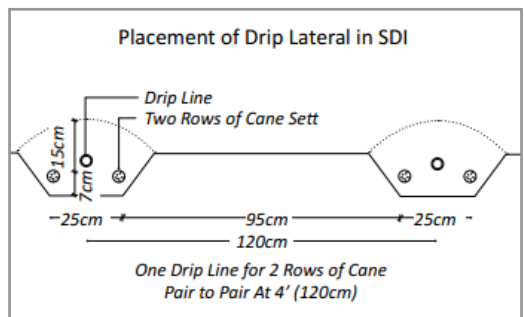
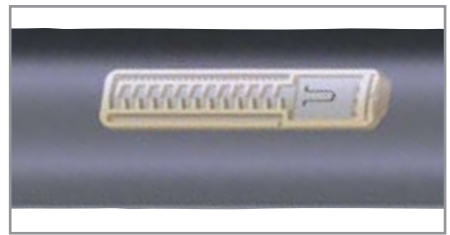
Roots prevention-Special dripper outlet protection available for thin walled driplines

SDI concept and procedure

Sub-Surface Irrigation system is most practical for sugarcane cultivation.

The diagram illustrates the new concept that contributes to better germination while achieving better protection for the drippers.

The drip line position in relation to the planted sette should enable successful germination and at the same time will minimize roots intrusion to the dripper.



SPRINKLERS IRRIGATION

The overhead sprinklers system is the traditional solution for lower cost investment and minimal maintenance needs.

The right selection of a system will be based on

- High distribution uniformity
- Low precipitation rate
- Low energy system

NaanDanJain sprinklers solutions

There are two main concepts: Skip along system with 2" gun sprinklers model 280 for spacing of 50m.

Solid - set system with 5035SD and 234 for spacing up to 24m.



5035SD



234



280



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

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All specifications are subject to change without notice.

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



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