GREENHOUSE

IRRIGATION SOLUTIONS & CLIMATE CONTROL

For many years NaanDanJain has been deeply involved with irrigation solutions for greenhouses, nurseries and tunnels. This brochure summarizes and highlights the range of products for various applications.

GREENHOUSES I TUNNELS I NET HOUSES I PROPAGATION TABLES I CLIMATE CONTROL I FERTILIZATION AND PESTICIDE SPRAYS I FROST PROTECTION

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GREENHOUSE & NET HOUSE IRRIGATION

TOTAL COVERAGE, OVERLAP CONCEPT

INVERTED SYSTEM

Inverted micro-sprinkler with optional LPD (leakage prevention device) is used for intensive full irrigation or as a pulsating system for the direct cooling of plants. The LPD allows immediate opening of the whole section at the same time and the pipes remain full of water between two operations. The surface level is free for cultivation and all other internal activities.

HADAR 7110

7110 inverted model with low-pressure LPD

PERFORMANCE TABLE 7110 INVERTED ROTOR AT 2 BAR PRESSURE

Nozzle (mm)	Nozzle color	Flow rate (l/h)	Diameter (m)	Precipitation (mm/h) Spacing (m)								
				3 x 3	3 x 4	3 x 5	4 x 4	4 x 5	4 x 6	5 x 5	5 x 6	6 x 6
1.1	Red	61	8.0	6.8	5.1	4.1						
1.3	Green	87	9.5	9.7	7.3	5.8	5.4	4.4		3.5		
1.4	Blue	103	10.0	11.4	8.6	6.9	6.4	5.2				
1.6	Yellow	128	10.2	14.2	10.7	8.5	8.0	6.4	5.3	5.1	4.3	3.6
1.8	Bright Green	166	10.6	18.7	14.0	11.2	10.5	8.4	7.0	6.7	5.6	4.7
2.0	White	199	11.0	22.1	16.6	13.3	12.4	10.0	8.3	8.0	6.6	5.5

Color code distribution uniformity	CU>92%	CU=89-92%	CU=85-88%	CU<85%

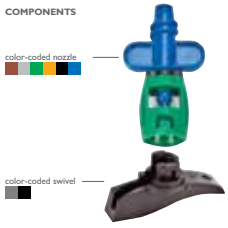
AQUAMASTER 2005

PERFORMANCE TABLE 2005 INVERTED AT 2 BAR PRESSURE

Nozzle color	Nozzle (mm)	Flow rate (l/h)	Diameter (m)	Precipitation rate (mm/h) Spacing (m)				
				3 x 3	4 x 4	4 x 6	5 x 5	6 x 6
Grey	1.14	70	9.0	7.7	4.4	2.9	2.8	
Green	1.40	105	10.0	11.7	6.6	4.4	4.2	2.9
Orange	1.50	120	10.5	14.0	7.9	5.3	5.1	3.5
Black	1.74	160	11.0	17.5	9.9	6.6	6.3	4.4

Color code distribution uniformity	CU>92%	CU=89-92%	CU=85-88%	CU<85%

GREEN SPIN



PERFORMANCE TABLE GREEN SPIN AT 2 BAR PRESSURE

Swivel color	Nozzle color	Flow rate (l/h)	Wetted diameter (m)	Precipitaion rate (mm/h) Spacing (m)								
				1.5x3	2x3	3x3	2x4	3x4	4x4	3x5	5x5	3x6
Grey	Brown	43	8.0	9.4	7	4.7						
	Grey	70	9.0	15.5	11.6	7.7	8.7	5.8	4.4			
	Green	105	9.0	23.4	17.5	11.7	13.2	8.8	6.6	7		
	Orange	120	9.5	26.4	19.8	13.2	14.8	9.9	7.4	7.9	4.7	
Black	Black	160	9.0	35.4	26.5	17.7	19.9	13.3	9.9	10.6	6.4	8.8
	Blue	200	9.5	44.3	33.3	22.2	24.9	16.6	12.5	13.3	8	11.1

Tested at laboratory conditions at 2.0m above ground

Color code distribution uniformity	CU>92%	CU=89-92%	CU=85-88%	CU<85%

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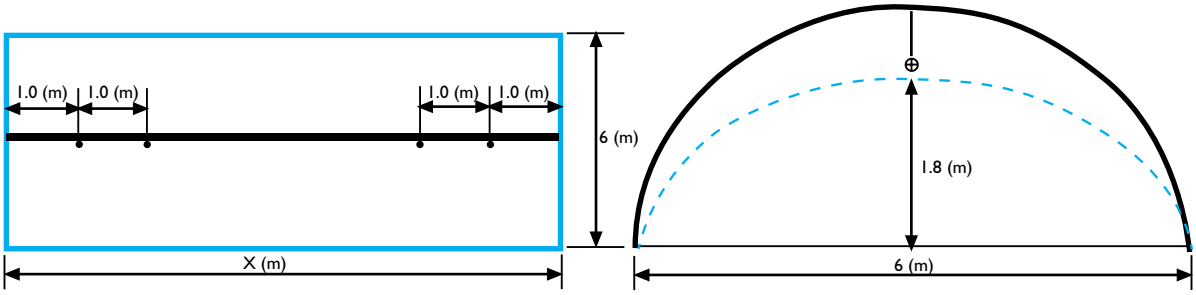
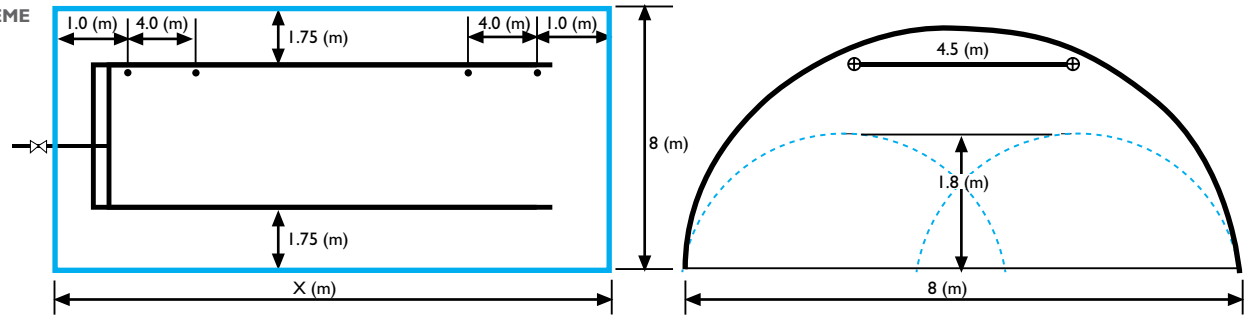
TUNNEL IRRIGATION

The inverted system is commonly recommended to keep the surface level free of obstacles. NaanDanJain has developed a unique concept - the side-by-side Anti-Mist - to achieve the highest uniformity of water distribution in the cultivated area, with minimal wetting of the plastic walls. For very wide tunnels, an additional lines has been designed.

SINGLE LINE SCHEME



DOUBLE LINE SCHEME



PERFORMANCE TABLE FOR TUNNELS - MODULAR INVERTED WITH ANTI-MIST

Tunnel width (m)	Swivel	Nozzle	Anti-mist	Flow rate (l/h)	Sprinkler spacing (m)	Lateral spacing (m)	Height (m)	Precipitation (mm/hr)	CU%	Effective watering %
3.0	small black	green	green	40	1.0	single	1.2	12.0	91	90
4.0	inverted green	green	green	40	0.5	single	1.2	8.0	93	80
5.0	inverted green	green	green	40	1.0	single	1.8	14.6	95	91
6.0	inverted green	blue	blue	120	1.0	single	1.2	19.0	93	95
7.0	small black	yellow	orange	70	1.0	3.6	1.8	19.0	91	95
8.0	small black	blue	yellow	90	1.0	4.5	1.8	20.4	96	91
9.0	small black	blue	blue	120	1.0	4.7	1.8	24.0	88	90
10.0	inverted green	green	green	40	1.0	5.2	1.8	7.4	93	92
11.0	inverted green	orange	orange	70	1.0	6	1.8	11.5	93	90
12.0	inverted green	blue	blue	120	1.0	6.5	1.8	18.0	92	90

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PROPAGATION AND ROOTING

The task of supplying controlled moisture and humidity means taking into consideration the various needs of the propagated seed and cutting at various substrates. The range of products- Foggers & Micro-sprinklers with various droplet sizes-maintain the desired condition in the nursery and the propagated tables.

Green Mist nozzle

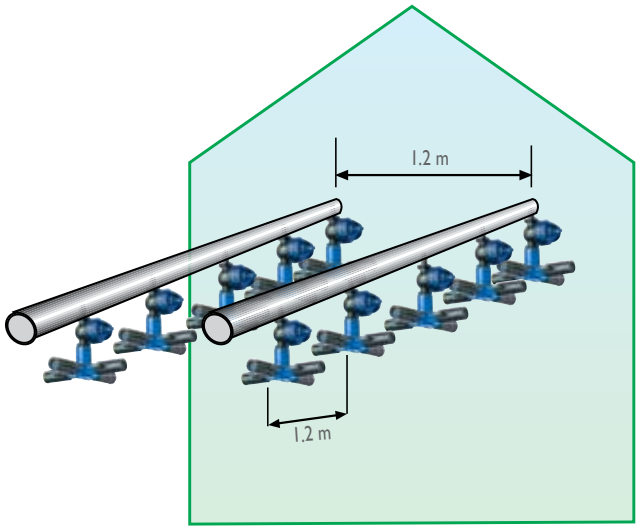
Green Mist with low-pressure Super LPD

4 Foggers on cross with high-pressure Super LPD

Hadar 7110 mist sprayer with low-pressure Super LPD bayonet

PRODUCT SELECTION TABLE FOR A GIVEN APPLICATION

Design factors / Emitter model	7110 mist head		Green Mist	Fogger on cross
Flow rate (l/h)	30	60	30	4x5.3 l/h 4x7 l/h
Spacing (m)	1.0 x 1.0	1.2 x 1.2	0.8 x 0.8	1.2 x 1.2
Lateral location from table edge* (m)	0.2	0.2	0.1	0.2
Minimal height installation (m)	0.6	0.6	1.0	0.8
Operating pressure (bar)	2-5	2-5	2-5	4-5
Main advantage	High uniformity	High uniformity	Free of drops	High uniformity and small droplets



Green Mist

7110 mist head

CLIMATE CONTROL Humidity and cooling systems

The Fogger and Super Fogger systems achieve optimal control of humidity and cooling in the greenhouse. This low-pressure system requires only 3.0/4.0 bar at the fogger inlet. The concept is based on natural air exchange and circulation. (The use of fans for circulation can improve results, but they're not a must). Temperature reduction is up to 10^0 C at hot dry days.


Cooling system for edible flowers


Cooling system in tomato greenhouse


Fogger T
14.0 l/h
with high-pressure
Super LPD

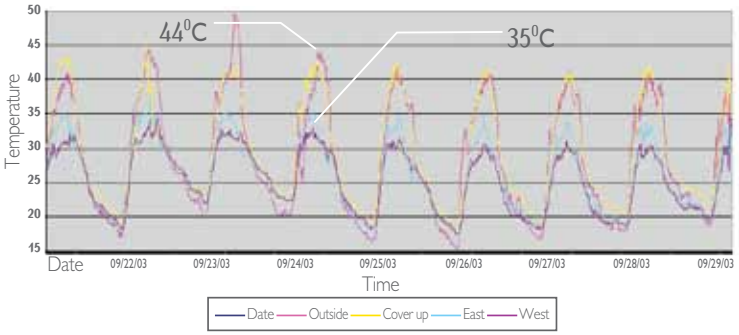
Super fogger 4 outlets


3.0 bar LPD
21l/hr

4.0 bar LPD
24l/hr

TEST RESULTS OF TOMATO GREENHOUSE, BEIT-SHEAN ISRAEL

The graph line show the temperature differences, in/out of the greenhouse with -10^{0}C



GUIDE LINES* FOR DESIGN AND INSTALLATION OF COOLING SYSTEM

Fogger model	Flow rate (l/hr)	Spacing (m)	Fogger height above surface (m)	Pressure at fogger inlet (bar)	Pulse duration (sec)	Time between pulses (sec)	Average water consumption (l/hr/ha)	Daily water consumption (m³/ha) 09:00-17:00
Fogger on cross	18-28	3.0 x 3.0	2.5-4.0	3.0/4.0	2.0-4.0	20-40	3,000-6,000	2.4-4.8
Super Fogger x 4	21/24	3.0 x 3.0	2.5-4.0	3.0/4.0	2.0-4.0	20-40	2,300-5,300	2.1-4.3

*For optimal results, prepare a fully detailed design.

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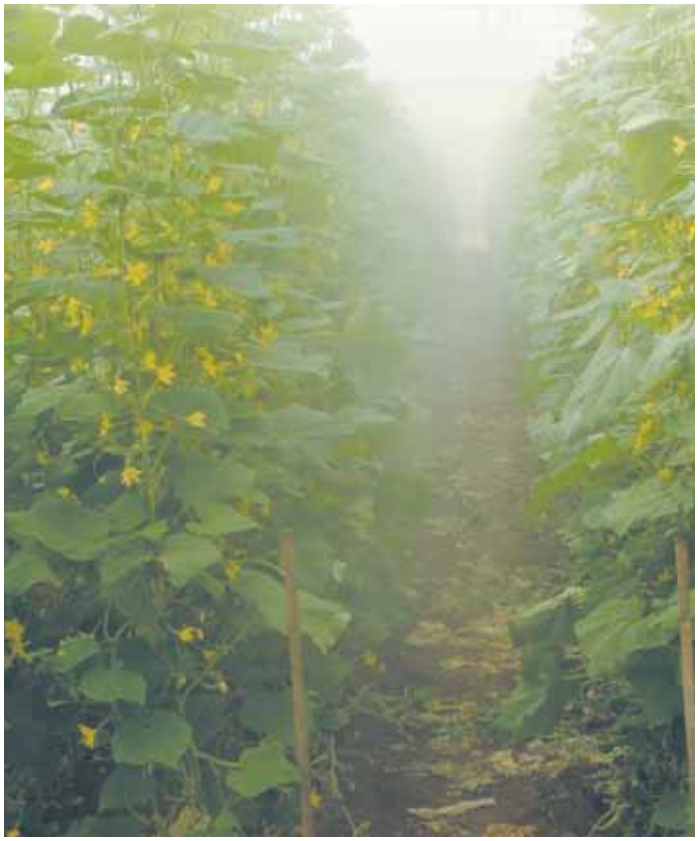
WET PAD – Cooling system with air suction

This concept is based on air exchange. The external dry air sucked in through a water drop screen.
The screen is made of triple layers of net (instead of the original, expensive, wet pad construction).
A set of fans mounted on the opposite wall create the air suction. The result is enriched moist air flow through the greenhouse, cooling the growing plants, without the salinty effect. The water distribution system is based on a half-circle (180^0) Modular sprayer, with a completely closed circulation of water.

Modular half-circle sprayer 100 l/h mounted every 1.0 m

PESTICIDE SPRAY SYSTEM

The pesticide spray system is based on the Fogger cooling system: one system; two tasks.
This preventative spray concept is operated by a single person who doesn't enter the greenhouse (fully safe).
The spray takes 1-2 minutes for each valve/section.
It facilitates immediate response to newly developed diseases.

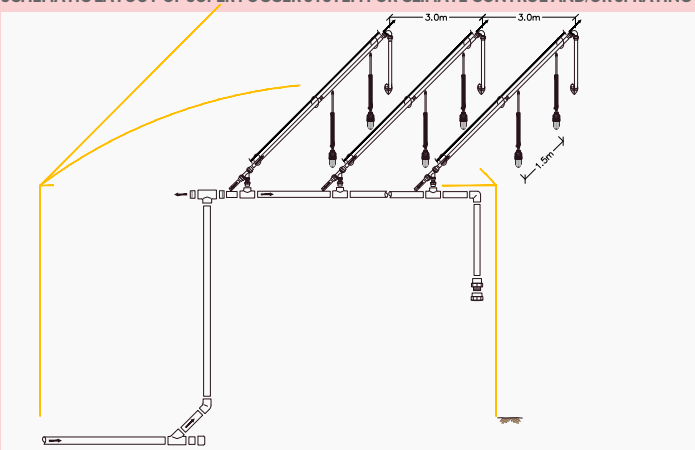


SUPER FOGGER DESIGN DATA

Spacing						
On the line (m)	Between the lines (m)	Unit flow rate (l/h)	Working pressure (bar)	Flow rate (l/hr/ha)	Minimal operation time (min.)	Recommended filtration grade
1.5	3.0	13.0	4.0	500	1.0	120

The pesticide & insecticide commonly used (liquid or powder form) are suitable for use in solution form too. Flush the fogger system at the end with water.

SCHEMATIC LAYOUT OF SUPER FOGGER SYSTEM FOR CLIMATE CONTROL AND/OR SPRAYING




Cucumber spraying

FROST PROTECTION

Frost protection can be achieved by NannDanJain micro-sprinklers that are designed to create an ice cover on the greenhouse or tunnel plastic cover.
In a net house this works under net, above the plants.
The ice formation isolates the greenhouse from the low temperatures outside.
The concept of operation is a continuous work not in pulses.
The system can work for temperatures up to -6^{0}C.


501 sprinklers
180 l/h, spacing 6-8 m


Mamkad 16
180 l/h, spacing 6-8 m


Tomato greenhouse, 501 sprinklers on the roof along the gutters


Frost damage to tomato bushes after a night of frost


Undamaged tomato bushes in nearby greenhouse with 501-U frost protection


7110 Inverted, 60 l/h as frost protection in an asparagus net house

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Drip irrigation

Drip irrigation systems ensure high irrigation accuracy and water use efficiency. They also give a precise solution for fertigation. In many greenhouses the crop is grown in a soilless medium and in small volume receptacles that requires high frequency irrigation. To achieve uniformity in such cases it is recommended to use CNL (Compensating non-leakage) drippers that maintain the system full and ensure that all drippers start and stop simultaneously.

ClickTif HD

Heavy duty, Pressure Compensating & PC Non-Leakage (CNL) Button Drippers, for irrigation of pot plants, grow-bags and gutter growing systems

Taper lock outlet | Barb outlet 3/5

PC CNL PC CNL

1.3 l/h 2.0 l/h 3.0 l/h 4.0 l/h 8.0 l/h 12.0 l/h

TECHNICAL DATA

- Nominal discharge: 1.3, 2.0, 3.0, 4.0, 8.0, 12.0 l/h
- Regulating pressure range: 0.5-4.0 bar
  CNL: 1.0-4.0 bar
- CV: less than 4%
- Minimum recommended pressure 1.0 Bar
- Non-Leakage (CNL): - Opening pressure: 8.0 m
  - Closing pressure: 3.0 m

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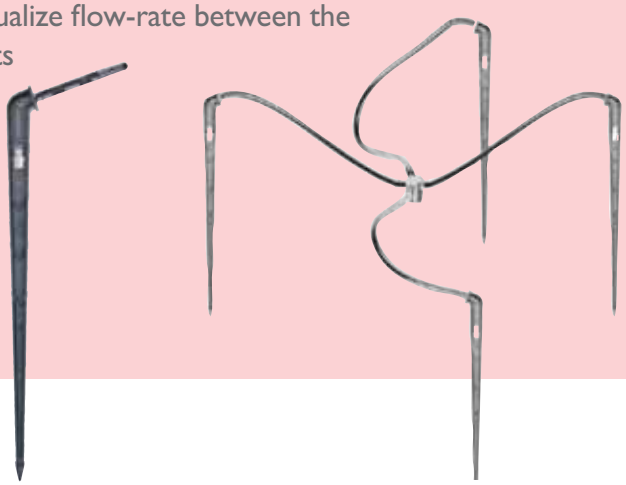
ClickTif HD Accessories and Assemblies

Drop Guide
Used for single outlet instalations

Labyrinth Stake
Used in multiple outlet instalations to equalize flow-rate between the outlets



All assemblies and stakes are available in Black or Gray colors

When working with multiple outlets:

1. Use labyrinth stakes to improve uniformity
2. Minimum recommended working pressure: 1 bar
3. Maximum recommended flow per outlet: 2.0 l/h
4. Minimum recommended flow per outlet:
   - Flat surface and uniform tube length - 0.5 l/h
   - On a slope or uneven elevation - 1.0 l/h

Recommended combinations:

Number of outlets	Dripper flow rate l/h					
	1.3	2	3	4	8	12
2	●	●	●	●	-	-
3	-	●	●	●	-	-
4	-	●	●	●	●	-
5	-	-	●	●	●	-
6	-	-	●	●	●	●

● Only on flat surface and with uniform tube length
● For all conditions, including slopes and uneven elevations

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AmnonDrip CNL

Pressure compensating, non leakage integral dripline
for irrigation of substrate beds or soil grown crops

1.1, 1.6, 2.2, 3.8 l/h

TECHNICAL DATA

- Flow rate: 1.1, 1.6, 2.2, 3.8 l/h
- CNL: Opening pressure - 1.0 bar
  Closing pressure - 0.20 bar
- Pressure regulating range:
  PC CNL - 1.0-4.0 bar
- Filtration recommended: 130 micron (120 mesh)

NDJ PE DL PIPES

Double layer, poly- ethylene pipes for micro-sprinkler and button dripper installation. Featuring a UV protected white external coating.

Why White?

When working with non- leakage emitters such as button drippers or micro-sprinklers, the system remains full and water inside the pipes tends to heat up. Irrigating small plants with hot water can damage the plants. NaanDanJain's PE DL PIPES (with a double layer, external white and internal black) reduce water temperature up to 8°C, while also ensuring that light doesn't penetrate and provoke algae formation in the pipe. Using light-colored pipes and accessories also allows optimal radiation for photosynthesis.

TECHNICAL DATA

Diameter (mm)	PN (ATM)	Wall thickness
16 20 25	2.5	1.2 1.3 1.4
16 20 25	4	1.4 1.5 1.9
16 20 25	6	1.8 2.3 2.8

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NaanDanJain Irrigation Ltd.
Post Naan 7682900, Israel. T:+972-8-9442180, F:+972-8-9442190
E: mkt@naandanjain.com www.naandanjain.com

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