Irrigation Technology for the Future

Water for Profit Statewide Field Day – 22nd June 2016
Water Application Solutions

3000 Series Performance

• Uniformity
• Droplet Configurations
• Efficiency
• Throw Distance
• Average Application Rate
• Instantaneous App. Rate
• Runoff
• Mounting Height
• Dual Nozzle Clip
• Dry Wheel Tracks
• Pressure Regulators

End Gun Solutions

Equations & Conversions
Nelson Irrigation Corporation offers a full-range of water application solutions for center pivot irrigation. From control valves, to pivot sprinklers and pressure regulators to end guns — the package is complete. Efficiency and effectiveness are at the heart of this superior center pivot irrigation package.

Nelson 3000 Series Pivot Sprinklers- built around the foundation of the 3TN quick-change nozzle system - provide the best water application solutions for your specific GeoCropical needs. Choose the R3000 Rotator for ultimate uniformity with the widest throw available on drops. The R3000 Rotator is best in class at getting water end the ground, minimizing conditions that cause runoff and erosion.

Nelson Pressure Regulators deliver accurate pressure control in demanding conditions. The patented single-strut inlet seat provides greater plug resistance than other designs.

And, for end guns - look to the Nelson SR75 or SR100 Big Guns® for extended wear life and trouble free operation.

For system control and end gun operation specify Nelson 800 Series Control Valves.
GEOCROPICAL Solutions

Figuring out how to best grow crops for your particular place on earth is very important to us. Nelson water application solutions take into account specific soil types, crop rotations and farming practices. Let us help you identify your geocropical® needs.

We have coined the term GEOCROPICAL to describe our customized sprinkler offerings. It refers to optimizing sprinkler package configurations to meet the specific needs inherent to the geography and the specific crops in question. No one sprinkler package is right for all applications. We have engineered solutions to provide you the very best results whether you’re growing corn in Nebraska, potatoes in Idaho, sugar cane in Brazil or wheat in Croatia.
GeoCropical® Solutions

No one sprinkler package is right for all conditions. Look to Nelson for customized water application solutions.
### Pivot Sprinkler Flow

\[
Q_s = (\text{dfp} \times (\text{gpm/ac}) \times \text{ss})
\]

- \( Q_s \): gpm required
- \( \text{dfp} \): distance
- \( \text{ss} \): sprinkler spacing

<table>
<thead>
<tr>
<th>% of AREA</th>
<th>Length</th>
<th>Acres</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1320 ft.</td>
<td>125</td>
</tr>
<tr>
<td>75</td>
<td>1143 ft.</td>
<td>94</td>
</tr>
<tr>
<td>50</td>
<td>933 ft.</td>
<td>63</td>
</tr>
<tr>
<td>25</td>
<td>660 ft.</td>
<td>31</td>
</tr>
</tbody>
</table>

½ of acres under last 30% of pivot  
(2 acres under first span)
CENTER PIVOT SYSTEMS

- **Uniformity** Advantages
- Application Efficiency
- Labor Savings
- Energy Savings
- Dependable
- Cost Effective

‘Irrigation Uniformity Paper’
University of Idaho
Soil Factors
- How water moves in the soil
- General Limitations of each soil type

• Water Supply
  - Water quality
  - Water application droplet Size
  - Availability

• Crop Factors
  - Irrigation demands
  - Crop Rotation

• Mother Nature

• Germination & Chemigation considerations
MOTHER NATURE

CONSIDERATIONS OF WIND & TEMPERATURE

• Mounting on drops
• Select the Optimum 3000 Series Device
  – Plate Performance
    • Droplet Size
    • Throw Distance
    • Uniformity

• Watch the Extremes
  – Low mounting
  – Low Pressure
  – Aggressive Droplet
WATER “LOSSES” FROM CENTER PIVOTS

- Canopy Evaporation
- Droplet Evaporation
- Drift
- Runoff
- Crop Root Zone
- Deep Percolation
- Soil Surface Conditions & Practices

Sprinkler Device Performance
SOIL TYPE - LIMITATIONS

- **CLAY**
  - Low infiltration rates
  - Ponding, runoff potential

- **SILT**
  - Affected by droplet energy
  - Potential surface sealing

- **SAND**
  - Limited Storage Capacity
  - Deep percolation

**PARTICLE SIZE:**
- Clay: < 0.002 mm
- Silt: 0.002 - 0.05 mm
- Sand: 0.05 - 2.0 mm
WHY CONTROL RUNOFF?

RUNOFF CAUSED BY POOR WATER APPLICATION

DAMAGES SOIL & REDUCES PROFITS
RUNOFF

FACTORS OF POTENTIAL RUNOFF:

• Soil Characteristics
• Surface Storage
• Slope
• Average Application Rate (AAR)
• Instantaneous Application Rate (IAR)
• Sprinkler Performance
  - Throw Distance
  - Droplet Size & Kinetic Energy
CONTROLLING RUNOFF

APPLICATION VS. INFILTRATION

RATE (in./hr.)

RATE

INfiltration

POTENTIAL
RUNOFF

APPLICATION
PATTERN

TIME (minutes)

$T_p$
CONTROLLING RUNOFF

End of 1/4 mile system @ 8 gpm/ac and travel speed of 6 fpm.
# Sprinkler Performance

## Relative Throw Performance

<table>
<thead>
<tr>
<th>Product</th>
<th>Throw</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rotator</td>
<td>22m</td>
<td>D8 Orange Plate @ 20 psi; 9 ft.</td>
</tr>
<tr>
<td>Spinner</td>
<td>16m</td>
<td>D8 Yellow Plate @ 15 psi; 6 ft.</td>
</tr>
<tr>
<td>Accelerator</td>
<td>14m</td>
<td>Maroon Plate @ 10 psi; 6 ft.</td>
</tr>
<tr>
<td>Spray</td>
<td>8m</td>
<td>Brown Plate @ 6 psi; 3 ft.</td>
</tr>
</tbody>
</table>
AVERAGE APPLICATION RATE

\[ I_a = \frac{Q_p \times L_s}{A \times 1.59 \times L_d} \]

- \( I_a \): average application rate (mm/hr)
- \( Q_p \): pivot flowrate (m³/hr)
- \( L_s \): distance to sprinkler (m)
- \( A \): area irrigated by pivot (ha)
- \( L_d \): sprinkler throw diameter (m)

**Average Application Rate:**
The rate at which the depth of water increases if applied uniformly throughout the wetted area.
Compute the average application rate at the location of 300m from the pivot point.

- System flow is 240 m³/hr on 60.8 ha.
- Sprinkler coverage is 22m diameter.

\[
I_a = \frac{240 \times 300}{60.8 \times 1.59 \times 22}
\]

\[
I_a = 33.8 \text{ mm per hour}
\]

Compared to a 10m Diam = 74.5 mm/h
Mounting Options to Increase Footprint

- Single Drops – Sprinkler with Biggest Footprint
  critical
- Over Truss Rods – Stagger/Offset the location down each side
- Boom Backs
- Spreader Bars
- Relative Cost of each option
AVERAGE APPLICATION RATE

10.5 ft. (3.2 m) Offsets

22% Reduction in AAR
AVERAGE APPLICATION RATE
Boom Backs

16 ft. (4.9 m)
Offsets

30% Reduction in AAR
AVERAGE APPLICATION RATE

Spreader Bars
Instantaneous Application Rate: Peak intensity of water application at a point.

**SPRINKLER PERFORMANCE**

**INSTANTANEOUS APPLICATION RATE**

- **FIXED SPRAY**
- **MULTI-TRAJECTORY**
SPRINKLER PERFORMANCE

MINIMIZE DROPLET KINETIC ENERGY

- CONSISTENT DROPLETS
- LOW KINETIC ENERGY
- LOW INSTANTANEOUS APPLICATION RATES
Droplet Kinetic Energy: Equal to 1/2 the mass of the droplet multiplied by its velocity squared.

- Relatively Small Droplets
- Minimal Force
SOIL STRUCTURE

- **Aeration**: Gas exchange from soil and atmosphere.
  - What happens when the soil structure is destroyed?
    - **Compaction**
      - Poor infiltration.
      - Poor root penetration.
    - **Lack of O2**
      - Decreased nutrient absorption.
      - Decreased water absorption.
      - Decreased plant metabolism.
How do we Control the Output at each Outlet?

- **Regulator**
  - Critical to ensure the same Operating Pressure is at each outlet along the length of machine
  - Eliminates Topography effects
  - Real World operation Vs Theoretical fantasy (no wear)
  - Guarantees Uniformity control

- **Nozzle Size**
  - Ensures the correct Flow Rate is being distributed at that particular point of the machine to control AAR
  - Finite control: 1/128” increments of Nelson nozzle size
  - Guarantees Uniformity control
Improve Plug Resistance
PRESSURE REGULATORS

Precision Accuracy in Tough Field Conditions
Evapotranspiration (ET): net demand that must be replenished to maintain available supply of water for crop production.
Rotator®

S3000 Plates

D6-12" Red #5839

D6-20" Purple #6863

D8-21" Yellow #10381

S3000 Cap #9540

A3000 Plates

Mason #9006

A3000 Cap #10402

Gold Plugs & Cap Assy #11486-002

D3000 Plates

Turquoise #5971

Gray #5942

Orange #5080

Trailer #5070

Brown #5712

Red #5207

White #7071

Boon #5241

D3000 Sprayer Plate Assy #10400-040

Part Circle Conv. #11172

Use with A3000 & S3000 cap for 3-in-one sprinkler.

Part Circle Sprayer #9900-001

D0000 Stabilizer Attachment LEPAI #10177

HD0000 Hose Drag Adapter #4327

Part Circle Sprayer Head #8824-001

Trashbuster

Rotator® Plates

Up-Top U4-U8 Blue #8917

D4-9" Green #8944

RS000 Cap #9536

Spray Plates

10-20 PSI (70.3-138 Kpa)
9" Throat Clam: 0.4" (10.7 mm diam: 1.0 mm)

Black #11489-101

Blue #11488-102

Reasons to Upgrade
1. To add pressure regulators to compensate for pressure fluctuations and stabilize flow.
2. To replace old technology for better irrigation efficiency.
3. To improve irrigation uniformity.
4. To operate at lower pressure and save energy.
5. To improve crop yield and get a higher return on acre.
6. To adjust flow rate to match soil and crop requirements.
7. To replace worn-out sprinklers and nozzles.
8. To minimize operating costs.
9. To take advantage of local power utility cost-shading programs.
10. To reduce runoff and solve waste-tracking problems.

EFFICIENT. SUSTAINABLE. DEPENDABLE.

NELSON AUSTRALIA
INNOVATION IN IRRIGATION.
WHY THE PIVOT ROTATOR?
water application solutions
FOR CENTER PIVOT IRRIGATION

SAVE WATER, SAVE ENERGY AND DO A BETTER JOB OF IRRIGATING
WWW.NELSONIRRIGATION.COM

R3000 ROTATOR®

- New plate designs for better performance at lower pressures
- Greatest throw distance on drops for the lowest application rates and reduced runoff
- High uniformity with high efficiency
- No special mounting assembly required

EFFICIENT. SUSTAINABLE. DEPENDABLE.
R3000 Plate Technology

Multi-Trajectory Angles
R3000 Rotator
• Greater Throw Distance
• Higher Uniformity
• Reduced Wind Drift

Longer Soak Time, Reduced Runoff.
INSTANTANEOUS APPLICATION RATE

D3000 SPRAY

43' Diameter

Black Spray Plate
#36 3TN Nozzle @ 10 PSI

R3000 ROTATOR

70' Diameter

3848 SQ. FT.

9' Mounting Ht.
#36 3TN Nozzle @ 20 PSI
Superior Windfighting

Largest Footprint = Longest Soak Time  
Highest Uniformity = Max. Efficiencies

Less Water, More Uniform/Consistent Output = Higher Crop Value = Greater ROI
Nelson Rotator = High Uniformity, Low Application Rate, Largest Footprint

Nelson Rotator
Brown Plate, 36 Nozzle
15 PSI

Senninger I Wob
Black Plate, 18 Nozzle
15 PSI

60 Minute test, 1 frame every 10 seconds, compressed down to 12 seconds
SAVE WATER, SAVE ENERGY AND DO A BETTER JOB OF IRRIGATING

NELSON

WWW.NELSONIRRIGATION.COM

S3000 SPINNER

✔ Superior uniformity at low pressure
✔ Gentle, rain-like droplets
✔ No special mounting assembly required

EFFICIENT. SUSTAINABLE. DEPENDABLE.
S3000 SPINNER

Longer Life

ENGINEERING ENHANCEMENTS & MANUFACTURING PROCESS IMPROVEMENTS:

- Shielded Plate
- Shielded Retainer over Seal
- Ball Bearing
S3000 Spinner
• Greater Throw Distance
• Less Stream Collision
• Lower Instantaneous Application Rates
• Less Wind Drift
• Less Expensive

Solution: Single Plate - Multiple Trajectories

D3000 SPRAYHEAD
MULTIPLE TRAJECTORY PERFORMANCE

- Reduce Stream Collision from Single Trajectory Streams
- Fills in the Pattern
- Better Overlap
- Wider Wetted Band

Superior Windfighting | High Uniformity
SAVE WATER, SAVE ENERGY AND DO A BETTER JOB OF IRRIGATING

A3000 ACCELERATOR

- A new standard for in-canopy irrigation
- Maximize throw and minimize evaporation at low pressure
- No special mounting assembly required

NEW – A3000 CONVERTER
SAVE WATER, SAVE ENERGY AND
DO A BETTER JOB OF IRRIGATING

N3000 NUTATOR®

Larger, wind-fighting droplets
Maintains throw and uniformity at low pressure

WWW.NELSONIRRIGATION.COM

EFFICIENT. SUSTAINABLE. DEPENDABLE.
N3000 NUTATOR®

Function
- Random
- Oscilating
- Offset
O3000 ORBITOR

Traditional Black Plate Vs NEW Purple = Higher Uniformity
PART CIRCLE APPLICATIONS

Dry Wheel Track Packages
PART CIRCLE APPLICATIONS

Available in Rotator, Spinner & Spray.

Dry Wheel Track Packages
At the Towers – Enhance the Premium Sprinkler Package -- R3000 Rotator®

- As a LOW PRESSURE (<20 GPM) END GUN.

PC – R3000

- At the Towers – Enhance the Premium Sprinkler Package -- R3000 Rotator®
- As a LOW PRESSURE (<20 GPM) END GUN.
3000FC – PRINCIPLE OF OPERATION

WASTEWATER MANAGEMENT

T3000 Trashbuster

T3000 w/ Spray

T3000 w/Rotator®
UPGRADE YOUR SPRINKLER PACKAGE TODAY!

10 REASONS TO RETROFIT / RENOZZLE YOUR PIVOT

1. To add pressure regulators to compensate for pressure fluctuations and stabilize flowrate.
2. To replace old technology for better irrigation efficiency.
3. To improve irrigation uniformity.
4. To operate at lower pressure and save energy.
5. To improve crop yield and get a higher return per acre.
6. To adjust gallonage to match soil and crop requirements.
7. To replace worn out sprinklers and nozzles.
8. To minimize operating costs.
9. To take advantage of local power utility cost-sharing programs.
10. To reduce runoff and solve wheel-tracking problems.
NEW IMPROVEMENT OPPORTUNITIES

- Reduce Over-Watering
- Solve Wheel Tracking Issues
- Improve Uniformity
- Reduce Runoff
- Save Water & Energy
- Trade-Up from Conventional Sprayheads
- NEW Sprinkler Models, Plates…ongoing
- NEW! End Gun Opportunities
the original
BIG GUN® SPRINKLER

www.nelsonirrigation.com
NEW - R55A Low Pressure End Gun
NELSON 800 SERIES VALVES

In-Line Style