10 Frequently Asked Questions about Center Pivots

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1) How much water do I need?
2) Is my pond large enough to supply my irrigation water requirements?
3) What kind of sprinkler packages are available?
4) What type of water applicator is best?
5) What are the most common design problems seen with center pivots?
6) What size should my mainline pipe be?
7) Do I need pressure regulators?
8) What are the key design considerations for a pivot?
9) How can I check to see if my pivot is operating at design specifications?
10) What are the considerations when renozzling a pivot?

How Much Water Do I Need?

Irrigation Systems are designed to supply peak water demand of crops

(inches per day, inches per week etc.)

Bulletin 6019

Crop water demand information useful for sizing irrigation systems (shown are values for South Texas)

(copy of bulletin are posted at http://texaset.tamu.edu)

Crop	Peak Demand (inches/day)
cotton	0.23
corn	0.32
citrus	0.16
sorghum	0.22
perennial pasture	0.25
small grains	0.26
vegetables	0.16

Example: Pasture/forage in South Texas

Peak water demand

0.25 inches/day = 6789 gal/acre/day

(note: 1 ac-in = 27,154 gal)

Total Gallons Needed per day

10 acres	50 acres	100 acres	120 acres
67,885 (2.5 ac-in)	339,425 (1.04 ac-ft)	678,850 (12.08 ac-ft)	814,600 (2.5 ac-ft)

Example: Pasture/forage in South Texas

Peak water demand

0.25 inches/day = 6789 gal/acre/day

Pumping rate – 24 hours @ 100% efficiency

10 acres	50 acres	100 acres	120 acres
47 gpm	235 gpm	470 gpm	566 gpm

Example: Pasture/forage in South Texas

Peak water demand

0.25 inches/day = 6789 gal/acre/day

Pumping rate – 12 hours @ 80% efficiency

10 acres	50 acres	100 acres
117 gpm	587 gpm	1175 gpm

Pumping rate and irrigation capacity

- From Table 2 of *Center Pivot Irrigation* in notebook (assumes irrigating 24 hours per day)

GPM/acre	Inches per day	Inches per week1.5
1.5	.08	.55
2.0	.11	.75
3.0	.16	1.10
4.0	.21	1.50
5.0	.27	1.85
6.0	.32	2.25
7.0	.37	2.60
8.0	.42	2.97

Is my pond (tank) large enough to supply my water requirements?

Using an on-farm pond (or water storage facility) to provide 0.25 inches/day?

Calculate pond size:

surface area x average depth = water volume

(acres) (feet) (ac-ft)

Example: Pasture/forage in South Texas

Is your pond large enough to provide 0.25 inches/day?

Water Supply in Weeks (at 100% irrigation efficiency)	50 acre field	100 acre field	120 acre field
1	7 ac-ft	15 ac-ft	17 ac-ft
2	15 ac-ft	30 ac-ft	35 ac-ft
3	22 ac-ft	45 ac-ft	55 ac-ft

Example: Pasture/forage in South Texas

Is your pond large enough to provide 0.25 inches/day?

Water Supply in Weeks (at 80% irrigation efficiency)	50 acre field	100 acre field	120 acre field
1	9 ac-ft	19 ac-ft	21 ac-ft
2	19 ac-ft	38 ac-ft	44 ac-ft
3	28 ac-ft	56 ac-ft	69 ac-ft

How much money can I save by reducing my operating pressure?

Typical Pumping Costs in Texas:

Acre-inch per 100 ft head (or 43 psi)

type	Natural gas	Electric turbine	Electric centrifugal	Diesel
Cost	$1.49	$2.00	$2.52	$3.07
Fuel cost*	$11 MCF	$0.11 kwh		$2.65 gal

** my fuel costs on Oct 22, 2008*

Costs of Pressurizing Water

Per acre-foot of water,

electric centrifugal pump

at 0.11 kwh

pressure	15 psi	30 psi	45 psi	60 psi	90 psi
cost (per ac-ft)	$10.44	$20.76	$31.20	$41.64	$57.72

Costs of Pressurizing Water

For applying 1 ft of water on a 120 acre field:

electric centrifugal pump

at 0.11 kwh

pressure	15 psi	30 psi	45 psi	60 psi	90 psi
cost (per ac-ft)	$1253	$2492	$3744	$4997	$6926

What types of sprinkler packages are available?

(1) high pressure impacts

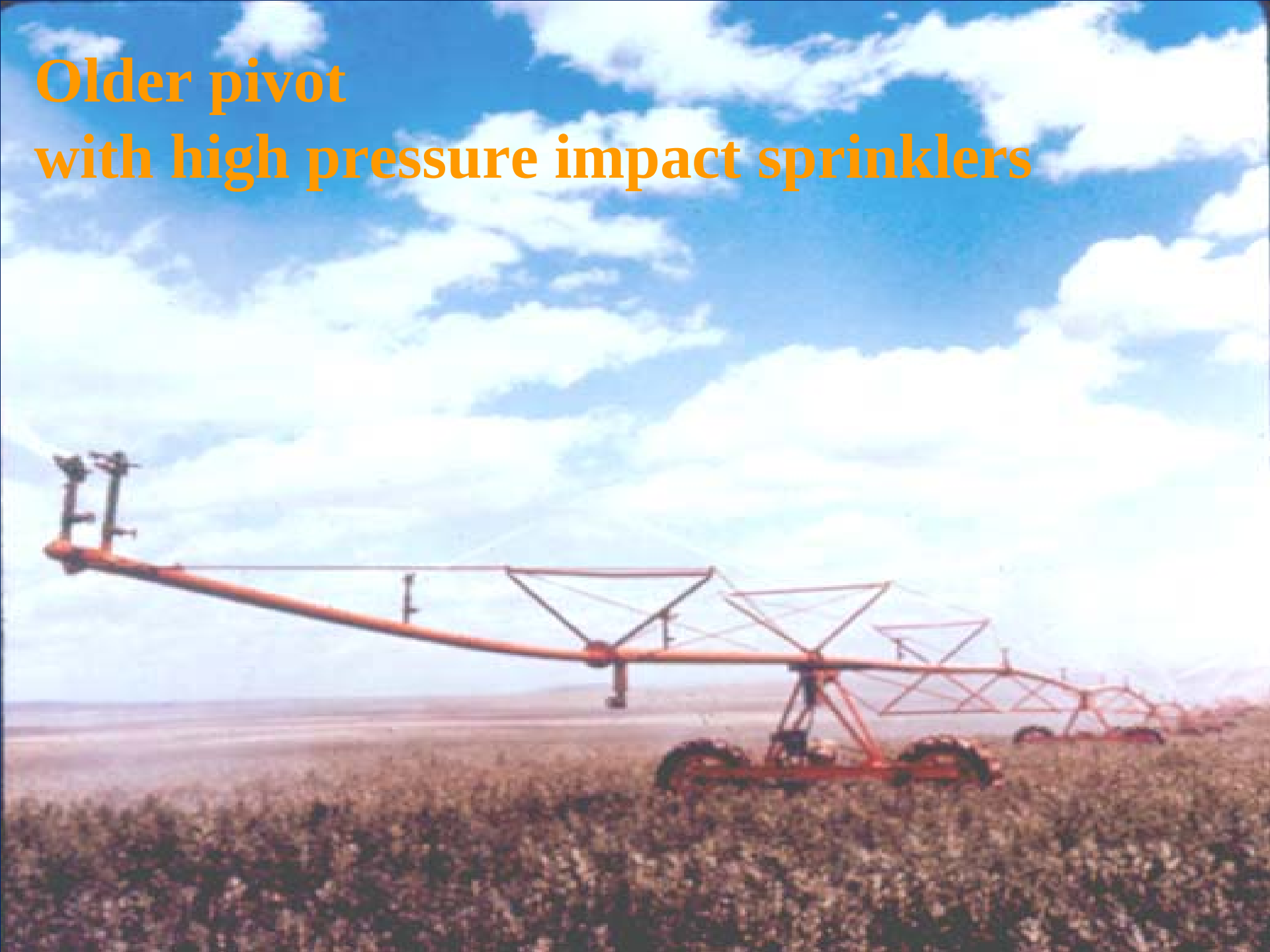
(2) medium elevation spray applicators (MESA)

(3) low energy precision applicators (LEPA)

(4) low elevation spray applicators (LESA)

Water-move pivot

Older pivot
with high pressure impact sprinklers




MESA
(medium elevation spray applicators)

MESA
(medium elevation spray applicators)

Over-pressured MESA system

LEPA
(low energy precision applicators)


LEPA
with alternate row furrow dikes

LESA
(low elevation spry applicators)

What types of applicator is best?

- LEPA and LESA:
  - have the lowest operating pressures (6 – 10 psi)
  - the highest efficiencies (90-98%)
  - But require higher skill level for proper irrigation water management
- LEPA may require practices to control runoff

What types of applicator is best?

- MESA
  - About 10% of the water applied to high canopy crops is lost to evaporation
  - Typical efficiencies are 80-90% with proper design

What are the most common design problems seen with center pivots?

- **mainline too small**
- **elevation changes in field not considered in the design**
- **end gun added**
- **system designed for incorrect flow rate**

What size should my mainline pipe be?

- For the same diameter pipe:
  - The higher the flow rate, the higher the friction losses
- Try to keep friction loses to 10 psi if practical
- Consider telescoping for larger flow rates and for half mile systems

What size should my mainline pipe be?

Friction loss in center pivot mainlines (psi)

Flow rate, GPM	Mainline pipe diameter, inches		
	6	6 5/8	8
500	8	5	
600	11	7	
800	18	11	4
1000	28	17	7
1200	39	24	9

What size should my mainline pipe be?

Telescoping Example:

Pivot is 1316 ft long with a flow rate of 1100 GPM

- Case 1: all 1316 ft is 6 5/8-inch pipe
  - Friction loss is 19 psi

- Case II: 640 ft of 8-inch and 676 ft of 6 5/8-inch
  - Friction loss is 10 psi

Do I need pressure regulators?

- Depends upon the:
  - Elevation change in the field

    (maximum change in elevation from pivot point to highest/lowest point in field
  - System design pressure (pressure at the nozzle)
- Regulators require about 3 psi more than their pressure rating to operate properly
  - A 6 pound regulator requires an operating pressure of 9 psi

Do I need pressure regulators?

- Pivots should be designed to maintain less than 20% variation in system design pressure

Table 5. % variation in design pressure

Elevation change, ft	**System design pressure (psi)**			
	10	20	30	40
2.3	10.0	5.0	3.3	2.5
4.6	20.0	10	6.6	5.0
9.2	40.0	20.0	13.3	10.0
13.9		30.0	20.0	15.0
18.5			26.6	20.0

What are the key design considerations for a pivot?

- elevation changes in field considered
- mainline pipe sized correctly
- efficient water applicators
- matched to available water supply
- matched to water requirements of crop

How can I check to see if my pivot is operating at design specifications?

- obtain a copy of the pivot design printout
- note the following:
    1) total flow rate
    2) pressure at the pivot point
    3) pressure at the last nozzle or pressure regulator

How can I check to see if my pivot is operating at design specifications?

- Do you have enough water (gpm) as measured by your flow meter?
- Is your flow meter accurate?
    - is the meter installed in a straight section which is at least 15 pipe diameters long?

How can I check to see if my pivot is operating at design specifications?

- Does the pressure match at the pivot point?
- Install a pressure gage in the last drop just above the water applicator or pressure regulator
- Is the pressure equal to or greater than what's required?

Considerations when renozzling (see Section 15 of Pivot Publication)

- Actual lowest and highest elevation in field in relationship to the pivot point is used in the computer design printout.
- Actual measured flow rate and pressure available by pump (or water source) is used in the computer design printout.
- Friction loss in pivot mainline for quarter-mile long systems is no greater than 10 psi.

Considerations when renozzling (see Section 15 of Pivot Publication)

- Mainline outlets spaced:
  - a maximum of 60 to 80 inches apart
  - or alternately, 2 times the crop row spacing.
- For non-leveled fields:
  - less than 20% pressure variation in system design operating pressure is maintained when pivot is positioned at highest and lowest point in the field
  - (computer design printout provided for each case).

Considerations when renozzling (see Section 15 of Pivot Publication)

- Pressure regulators are evaluated for fields with more than 5 feet elevation change from pad to the highest or the lowest point in the field.
- Copy of pivot design printout provided by dealer.
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Considerations when renozzling (see Section 15 of Pivot Publication)

- No end gun.
- Consideration was given to equipping the pivot with either LEPA or LESA applicators

Considerations when renozzling (see Section 15 of Pivot Publication)

- Propeller flow meter or other type of flow measurement device
  - with an accuracy of ± 3%
  - installed in water supply pipeline near pivot point in a straight section 10 pipe diameters upstream and 5 pipe diameters downstream from the flow meter.

Considerations when renozzling (see Section 15 of Pivot Publication)

- Two pressure gauges
  - one on the mainline near the pivot point,
  - one in the last drop, located just above the applicator or pressure regulator.

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