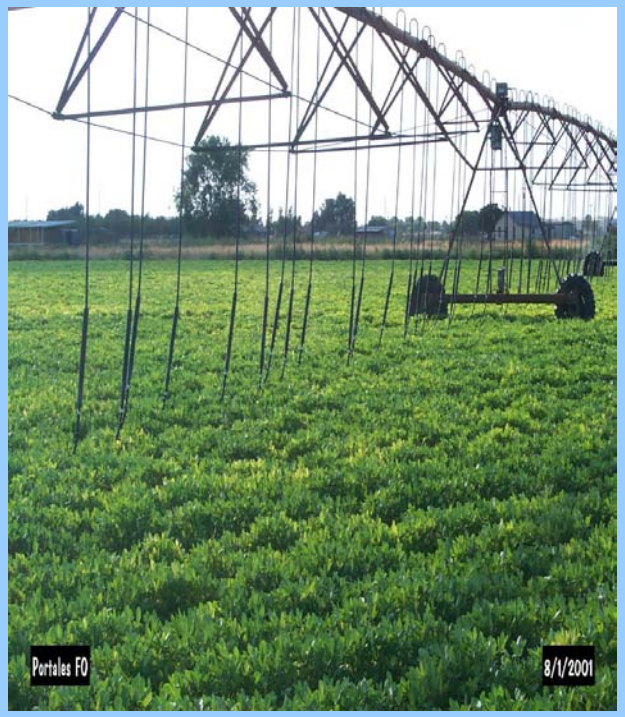
IS-5: Achieving Irrigation Water Management (IWM) with Pivot Sprinkler System

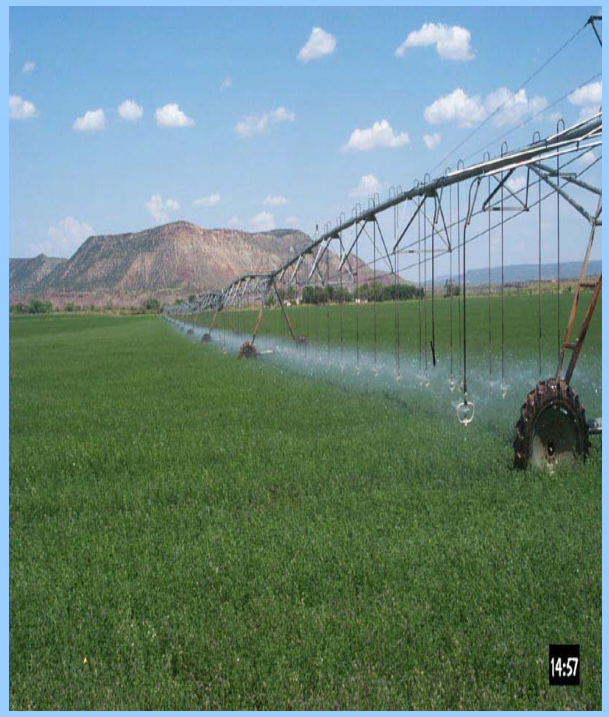
Basic Requirements:

- Water Source
- Pumping Plant
- Power Source
- Mainline
- Laterals
- Sprinklers
- Chemigation Valves
- Pressure Gauge
- Water Meters



LEPA System

Low Energy Precision Spray



LESA System

Low Elevation Spray

MESA System

Mid Elevation Spray

Page 2	Title	Purpose
Page 1	Achieving Irrigation Water Management (IWM) with Pivot Sprinkler Systems	To describe the basic requirements of pivot sprinkler systems
Page 2	Table of Contents	Table of Contents
Page 3	Pictures of basic sprinkler system hardware	To demonstrate the components that are required for a sprinkler system
Page 4	Pictures of basic LEPA system characteristics	To demonstrate agronomic characteristics of a lepa system
Page 5	Characteristics of Pivot sprinkler systems	Criteria: Design Capacity, Design App. Rate, Distribution Patterns, Nozzle Spacing, Heights, Slopes.
Page 6	System Planning and Design	Planning, Design and System Performance Requirements
Page 7	Crop and Soil Characteristics	Needed for planning & design and used for IWM documentation of irrigation efficiencies achieved
Page 8	Detailed Evaluation for Center Pivot Lateral Worksheet	Catch Can Data Worksheet
Page 9	System Evaluation and Potential Water Savings	Evaluates system performance
Page 10	Pictures of a basic sideroll irrigation system	To demonstrate basic characteristics of a sideroll system

NOTE: The above information and documentation is intended to serve as a simple-to-use GUIDE by producers, Natural Resource Conservation Service (NRCS) planners and others involved in Irrigation Water Management. For further assistance on the use of this GUIDE, contact your local NRCS.


Chemigation Valve
Portales FO
3/27/2008


HydroMag
Flow meter


Pressure Gauge
(Start)
Portales FO
9/10/2001


Pressure Gauge (End)
Portales FO


Furrow Diking
Soft Middles
Portales FO
8/1/2001

CHARACTERISTICS OF PIVOT SYSTEMS

Criteria	Center Pivot or Linear Move	LEPA	LESA	LPIC & MESA
Design Capacity	**Either**: Capacity to meet the peak water demands of all irrigated crops in the design area, **Or:** Capacity adequate to meet requirements of selected irrigations during critical crop growth periods when planning less than full irrigation			
Design Application Rate	Runoff, translocation and unplanned deep perculation shall be minimized			
Distribution Patterns	CU ≥ 85% or DU ≥ 76%, Nozzles ≤ 7 ft. high shall have a CU ≥ 90%	CU ≥ 94%	CU ≥ 94%	CU ≥ 90% for nozzles ≤ 7 ft. high, CU ≥ 85% for MESA for nozzles greater than 7 ft. high
Nozzle Spacing	Spray Nozzles shall be ≤ 25% of wetted diameter, and Impact Nozzles shall be ≤ 50% wetted diameter	Not to exceed twice the row spacing of the crop or 80 inches		Not to exceed every other row when operated in canopy for 50% or more of the growing season
Heights	Varies	8 - 18 inches	12 – 24 inches	5 – 10 feet
Slope	Not to exceed 20%	Not to exceed 1% on more than 50% of the field	Not to exceed 3% on more than 50% of the field	Not to exceed 3% on more than 50% of the field for fine textured soils, and not to exceed 5% on more than 50% of the field for coarse textured soils

SYSTEM PLANNING & DESIGN

PLANNING
Calculate the required system capacity
Determine water availability
Estimate your irrigated area
Physical considerations- H20 quality, Soil variations
DESIGN
Pivot- labor savings, operating costs
SYSTEM PERFORMANCE
System checks
System Capacity
System Uniformity
System Average Application Rate
System Field Application Efficiency

PLANNING

Calculate the required system capacity

$Q = \frac{453\ Ad}{f\ T}$

Area (ac)	120
Depth of water applied (in)	2
Irrigation period (days/interval)	3
Operating time (hrs/day)	24
Flow rate (gpm)	1510

Determine water availability

This is done through well testing

Estimate your irrigated area

$A = \frac{Q\ f\ T}{453\ d}$

Flow rate (gpm)	1000
Depth of water applied (in)	2
Irrigation period (days/interval)	2
Operating time (hrs/day)	24
Area (ac)	53

Physical considerations

H20 quality, Soil variations

DESIGN

Pivot

Labor
Operating Cost
Sprinkler Package

SYSTEM PERFORMANCE

System Checks

The supplier should provide this service
1. System Capacity
2. Distribution Uniformity
3. Energy Consumption

System Capacity

$Q = \frac{453\ Ad}{f\ T}$

A=Irrigated area (acres)
d=Gross depth of water applied (in.)
f= Irrigation period (#days in #day interval)
T=hrs./day (operating system)

System Uniformity

Catch Can

System Average Application Rate

Ratio of nozzle flow rate to its wetted area

Where AAR exceeds the infiltration rate runoff results

System Field Application Efficiency

$\text{App. Eff.} = \frac{\text{Irr. Water available to crop}}{\text{Volume of water supplied}} \times 100$

NOTE:.

Soil (Series, Texture, and Map Unit) *Select the soil to manage for:*			
Critical soil to manage:	**Zia SL; 91**	Intake Family (in/hr):	**0.75**

Soil Interpretations for Irrigaiton

Crop Name	Rooting Depth	Moisture Replacement Depth (ft)	Water Holding Capacity (in)	Mgt Allowed Depletion (MAD) (%)	Net Water to Replace (in)	Time Needed to Infiltrate (hrs)
Alfalfa, hay, northern; Albuquerque	Deep	4.0	5.0	50%	2.5	2.0

Crop Consumptive Use (CU) Information *(inches/month needed)*

Crop:	Alfalfa, hay, northern; Albuquerque	Total Irrigation Needed:	41.5 ac in/ac

Month	Est. Frequency *(days between irr.)*	In/Mo	Month	Est. Frequency *(days between irr.)*	In/Mo
Jan		0.0	Jul	8	9.7
Feb		0.0	Aug	10	7.8
Mar		0.0	Sep	14	5.3
Apr	>1 Mo.	1.4	Oct	>1 Mo.	2.2
May	12	6.1	Nov		0.0
Jun	8	9.0	Dec		0.0

Detailed Evaluation Center Pivot Lateral Worksheet

Catch Can Spacing ft

Can No.	Factor No.	Catch (cc)	Catch x Factor	Catch (in.)
1			0	0.00
2			0	0.00
3			0	0.00
4	4	60	240	0.30
5			0	0.00
6			0	0.00
7			0	0.00
8	8	70	560	0.35
9			0	0.00
10			0	0.00
11			0	0.00
12	12	75	900	0.38
13			0	0.00
14			0	0.00
15			0	0.00
16	16	70	1120	0.35
17			0	0.00
18			0	0.00
19			0	0.00
20	20	80	1600	0.40
21			0	0.00
22			0	0.00
23			0	0.00
24	24	60	1440	0.30
25			0	0.00

Low 1/4 Summation

Can No.	Factor No.	Catch (cc)	Catch x Factor	Catch (in.)
44	44	35	1540	0.18
			0	0.00
			0	0.00
			0	0.00
36	36	55	1980	0.28
28	28	55	1540	0.28
			0	0.00
			0	0.00
	108		5060	

Max application rate data for 5

Catch Time min

1		15		
2		25		
3		35		
4		25		
5		20		
		35		

SYSTEM EVALUATION AND POTENTIAL WATER SAVINGS

Existing System Data

Crop	Stage of growth	Hours per revolution	Speed setting	Annual Net application (in)	Hours operated per day	Revolutions per season
alfalfa	16"	26	50%	14.9	24	80

Distance from/to		End tower speed		System Flow Rate	
pivot point end tower	pivot point wetted edge	Distance (ft)	Time (min)	Flow rate (gpm)	Method of measuring flow
1205	1345	50	10.8	850	flow meter

System Evalutation

Circumference of end tower (ft)	End tower speed (ft/hr)	Hours per revolution	Area irrigated (ac)	Gross app. per irrigation (in)
7571	278	27.3	130.5	0.39

Catch Can Evalutation

Weighted system ave. application (cc)	Average Application (in)	Weighted low 1/4 ave. application (in)	Low 1/4 Average Application (in)	DU	CU
58.94	0.29	46.85	0.23	79.49	87.08

Re	Eq	Application (in)	Max ave. app. Rate (in/day)	Pivot revolutions required	Annual Gross application (in)
0.752	59.760219	0.21	2.10	64	24.9

Potential Water Savings

Potential Application Efficiency %	Potential annual gross applied (in)	Total Water Conserved (ac-ft)
80	18.6	68.6

Sideroll Irrigation