Irrigation Facts

Water Measurement
1 gallon = 8.3 pounds
1 cubic foot = 7.48 gallons = 62.4 pounds
450 gallons per minute (gpm) =
  1 cubic foot per second (cfs) = 1 acre-inch per hour
1 acre-inch = 27,000 gallons = 1 acre flooded 1 inch deep
1 acre foot = 12 acre-inches = 43,560 cubic feet = 325,900 gallons
1 gallon = 3.785 liters = 0.003785 cubic meters
1 cubic meter = 1000 liters = 264.2 gallons

Pressure
1 column of water 2.31 feet high exerts a pressure of 1 psi
1 pound per square inch (psi) = 2.31 feet of water
1 atmosphere = 14.7 psi = 33.95 feet of water
1 inch of mercury (hg) = 1.13 feet of water
psi X 2.31 = feet of head
Total dynamic head (TDH) in feet includes:
  pumping lift in feet
  elevation change in feet
  friction loss in feet
  system operating pressure in feet
TDH = lift + elevation change + friction + pressure

Horsepower
Water horespower (WHP) - power required to lift a given quantity of water against a given total dynamic head

$$WHP = \frac{Q \times H}{3960}$$ Q = flow rate (gpm)
  H = total dynamic head (feet)

Brake horespower (BHP) = required power input at the pump

$$BHP = \frac{Q \times H}{3960 \times E}$$ Q = flow rate (gpm)
  H = total dynamic head (feet)
  E = pump efficiency as a decimal
  (assume .75 unless known)

Water Application
Application amount (H) inches:

$$H = \frac{QT}{A} = \frac{\frac{gpm}{450} \times time}{acres}$$

Q = flow rate in acre-in./hr = gpm/450
T = length of application (hours
A = area irrigated in time T (acres)

Maximum application rate for outer sprinklers of a center pivot:

$$AR = \frac{Q \times 122.5}{R \times r}$$

Q = gpm of sprinkler system
R = length of center pivot (ft.)
r = radius of sprinkler heads at distance R
AR = application rate (inches/hr)

Furrow irrigation set size (acres):

$$\frac{\text{No. of rows X row width (feet) X row length (feet)}}{43,560}$$

Approximate acreage covered by a pivot:

$$\frac{\text{Radius of pivot wetted area*,feet)}^2 \times 3.14}{43,560}$$
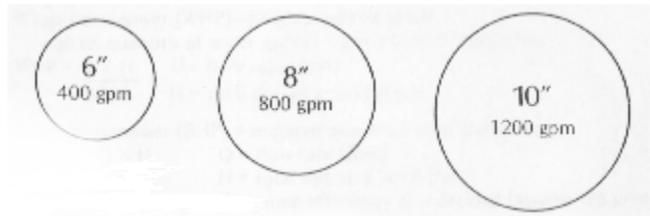
*Wetted radius includes radius of end gun

Flood irrigation set time:

$$T = \frac{A \times D}{Q}$$

T = pumping time to flood a field to depth (D), in hours
D = depth of flood (inches)**
A = area of field to be flooded (acres)
Q = flow rate acre-inches/hr = GPM

**Allow for 1" additional water for seepage and other losses on newly flooded fields.

Maximum economical pipe flow capacities:
RULE OF THUMB - Based on maximum velocity of 5 ft/sec.

James G. Thomas, Extension Agricultural Engineer

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