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Weight of Water per Acre from One Inch of Rain

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Water is an integral part of living systems and is essential for plant and animal life. Water in the form of precipitation is unevenly distributed over the land. Each inch of rain is relatively heavy. One inch of rain on a square foot of land weighs 5.20 pounds. One inch of rain on one acre of land weighs 113.31 tons.

The purpose of this report is to explain two procedures to determine the weight of one inch of rain on one acre of land.

The first approach determines the number of cubic inches of water on one acre and the weight in pounds of one cubic inch of water, then uses these values to determine the weight of one inch of rain on one acre. One acre is one rod wide and one-half mile long. A rod is 16.5 feet. A mile is 5280 feet, and a half mile is 2640 feet. The number of square feet in an acre is 16.5 feet times 2640 feet, which equals 43,560 square feet per acre. There are 144 square inches in a square foot. The number of square inches per acre is 43,560 square feet times 144 square inches, which equals 6,272,640 square inches per acre. One inch of rain times 6,272,640 square inches per acre equals 6,272,640 cubic inches of water per acre. One pint of water weighs one pound (1.04316 lbs/pint). One gallon of water weighs 8.3453 pounds. One cubic foot of water contains 7.48052 gallons. The weight of one cubic foot of water is 7.48052 gallons times 8.3453 pounds, which equals 62.42718356 pounds of water per cubic foot. One cubic foot contains 1728 cubic inches. The weight of one cubic inch of water is 62.42718356 pounds divided by 1728 cubic inches, which equals 0.036126842 pounds of water per cubic inch. The weight of one inch of rain on one acre of land is 6,272,640 cubic inches of water per acre times 0.036126842 pounds of water per cubic inch, which equals 226,610.6763 pounds of water per acre. There are 2000 pounds in one ton. The weight of water per acre, 226,610.6763 pounds

divided by 2000 pounds per ton, equals 113.3053382 tons of water in one inch of rain on one acre of land.

The second approach determines the number of gallons in one inch of water over one acre and then determines the weight of that number of gallons of water. One cubic foot of water contains 7.48052 gallons. There are 1728 cubic inches in one cubic foot. The number of gallons of water in a cubic inch is 7.48052 gallons divided by 1728 cubic inches, which equals 0.004329005 gallons per cubic inch of water. There are 6,272,640 cubic inches of water on one acre. This value times 0.004329005 gallons per cubic inch equals 27,154.2876 gallons of water per acre. One gallon of water weighs 8.3453 pounds. The weight of water per gallon, 8.3453 pounds, times 27,154.2876 gallons of water per acre equals 226,610.6763 pounds of water per inch of rain on one acre. This value divided by 2000 pounds per ton equals 113.3053382 tons of water per acre.

Value Equivalents

1 acre is 1 rod wide and $\frac{1}{2}$ mile long

1 rod = 16.5 feet

1 mile = 5280 feet, $\frac{1}{2}$ mile = 2640 feet

1 acre = 43,560 sq feet

1 sq foot = 144 sq inches

1 acre = 6,272,640 sq inches

1 inch rain on 1 acre = 6,272,640 cu inches water

1 gallon water = 8.3453 pounds

1 cu foot water = 7.48052 gallons

1 cu foot water = 62.42718356 pounds

1 cu foot = 1728 cu inches

1 cu inch water = 0.036126842 pounds

1 cu inch water = 0.004329005 gallons

1 acre inch of water = 27,154.2876 gallons

1 acre inch of water = 226,610.6763 pounds

1 ton = 2000 pounds

1 acre inch of water = 113.3053382 tons

Mathematical Calculations

Procedure #1

1 acre = 43,560 sq feet/acre X 144 sq in/sq ft = 6,272,640 sq in/acre

X 1 in rain = 6,272,640 cu in water/acre.

1 gallon = 8.3453 pounds X 7.48052 gallons/cu ft =

62.42718356 lbs of water/cu ft ÷ 1728 cu in/cu ft =

0.03612682 lbs of water/cu in X 6,272,640 cu in/acre =

226,610.6763 lbs of water/acre ÷ 2000 lbs/ton = 113.3053382 tons

water/acre per 1 inch rain.

Procedure #2

1 cu foot water = 7.48052 gallons ÷ 1728 cu in/cu ft =

0.004329005 gallons/cu in of water.

1 acre = 43,560 sq ft/acre X 144 sq in/sq ft = 6,272,640 sq in X 1 in rain =

6,272,640 cu in water/acre X 0.004329005 gallons/cu in =

27,154.2876 gallons of water/acre X 8.3453 lbs/gallon =

226,610.6763 lbs water/acre ÷ 2000 lbs/ton = 113.3053382 tons

water/acre per 1 inch rain.

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