SFMA SPORTS FIELD MANAGEMENT ASSOCIATION

Pre-Conference Education Sessions

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Turfgrass Math

SFMA 2024 Conference

Daytona Beach, FL

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Irrigation Calculations

Practical problems involving irrigation.

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Irrigation Calculations

- Total water use
- Cost of irrigation water
- Capacity of storage lakes and ponds.

- This will not cover irrigation system design and many of the more complex irrigation calculations.

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Important Facts

- Acre foot
  - The amount of water required to cover one acre (43,560 ft^2) to a depth of one foot.
  - 1 acre foot = 325,851.4 gal
- To cover 5 acres with one foot of water would require:
  - (5)(325,851.4 gal) = 1,629,527 gal of water

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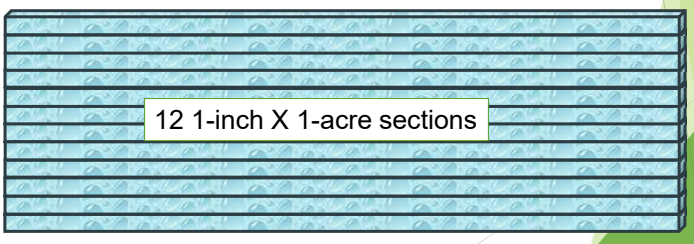
Important Facts

- Acre foot
  - Turf irrigation is made on a bases of inches not feet.
  - 1 acre foot is made up of twelve 1-inch sections.



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Important Facts

- Acre inch
  - 1/12th of 1 acre foot.

$$\frac{\text{1 acre inch} = \text{325,851.4 gal/acre foot}}{\text{12 in/foot}}$$

= **27,154.3 gal** in 1 acre inch

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Total Water Use

- Amount of water a irrigated area consumes.

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Total Water Use

If 40 acres of turf were to be irrigated with 1 inch of water, how many gallons would need to be applied to the area?

Facts:
There are 40 acres, each receiving 1 acre inch of water.
There are 27,154.3 gal of water in 1 acre inch.
Therefore:

(27,154.3 gal/acre inch)(40 acres) = 1,086,172 gal to apply 1 inch of water to 40 acres.

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Cost Example

A sports complex is looking at the possibility of connecting to the city water system.

There are 55 acres of irrigated native soil fields and 110,000 ft^2 of sand-based areas.

Part 1: How much water would be needed by the facility during a peak irrigation week in midsummer?

Part 2: Estimate the total water cost for the season, given a cost of $0.03 per cubic foot ($ft^3$) of water.

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Cost Example

Assumptions Part 1:

- A total of 1.2 inch irrigation, including adjustments for evaporation, will be needed in a peak irrigation week on the native soil.
- A total of 1.8 inch irrigation, including adjustments for evaporation, will be needed in a peak irrigation week on the sand-based areas.

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Cost Example

Determine total water use for 1 week period.

A. Native soils: There are 55 acres to be irrigated that are to receive 1.2 inches of water during a peak week of irrigation.

1) $\frac{27{,}154.3 \text{ gal}}{1 \text{ in}} = \frac{X \text{ gal}}{1.2 \text{ in}}$

2) (27,154.3 gal)(1.2 in) = X gal

3) X = 32,585.2 gal to apply 1.2 in to 1 acre

4) X = (32,585.2 gal) (55 acres)

X = 1,792,186 gal of water will be required in 1 week to apply 1.2 inch of water to 55 acres native soil.

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Cost Example

Determine total water use for 1 week period.

B. Sand-based: There are 110,000 ft² of irrigated sand-based areas that are to receive 1.8 inches of water during a peak week of irrigation.

1) $\frac{27{,}154.3 \text{ gal}}{1 \text{ in}} = \frac{X \text{ gal}}{1.8 \text{ in}}$

2) (27,154.3 gal)(1.8 in) = X gal

3) X = 48,877.7 gal to apply 1.8 in to 1 acre

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Cost Example

Determine total water use for 1 week period.

B. Sand-based: There are 110,000 ft² of irrigated sand-based areas that are to receive 1.8 inches of water during a peak week of irrigation.

4) $\frac{48{,}877.7 \text{ gal}}{43{,}560 \text{ ft}^2} = \frac{X \text{ gal}}{110{,}000 \text{ ft}^2}$

5) $(X) = \frac{(48{,}877.7 \text{ gal})(110{,}000 \text{ ft}^2)}{43{,}560 \text{ ft}^2}$

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Cost Example

Determine total water use for 1 week period.

B. Sand-based: There are 110,000 ft² of irrigated sand-based turfgrass that are to receive 1.8 inches of water during a peak week of irrigation.

6) X = 5,376,547,000 ÷ 43,560 ft²

7) X = 123,428.5 gal of water will be required in 1 week to apply 1.8 inch of water to 110,000 ft² of sand-based turfgrass.

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Cost Example

Determine total water use for 1 week period.

C. Total water requirement during a peak irrigation week.

1,792,186.0 gal (native soils)
+ 123,428.5 gal (sand-based)
1,915,614.5 gal is the total water use for a 1-week period.

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Cost Example

- Assumptions for Part 2 – Cost of water for one season.
  - 15 in of irrigation water for native soil areas.
  - 21 in of irrigation water for sand-based areas.

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Cost Example

Determine the cost of water for 1 season.

A. Native soils: It was calculated that 1,792,059.5 gal of water will be needed to apply 1.2 in of water to 55 acres of native soil sports fields. How much water will be needed to apply 15 in.

1) $\frac{1{,}792{,}186 \text{ gal}}{1.2 \text{ in}} = \frac{X \text{ gal}}{15 \text{ in}}$

2) [(1,792,186 gal)(15 in)] ÷ 1.2 in = X gal

3) X gal = 26,882,790 gal ÷ 1.2 in

4) X = 22,402,325 gal of water will be required to irrigate the native soil fields for one season.

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Cost Example

Determine the cost of water for 1 season.

B. Sand-based: It was calculated that 123,420 gal of water will be needed to apply 1.8 in of water to sand-based turfgrass. How much water will be needed to apply 21 in.

1) $\frac{123{,}428.5 \text{ gal}}{1.8 \text{ in}} = \frac{X \text{ gal}}{21 \text{ in}}$

2) (123,428.5 gal)(21 in) = (1.8 in)(X gal)

3) 2,591,998 gal ÷ 1.8

4) X = 1,439,999 gal of water will be required to irrigate the sand-based turfgrass areas for one season.

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Cost Example

Determine the cost of water for 1 season.

C. Total water requirement for the season

22,402,325 gal (native soil fields)
+ 1,439,999 gal (sand-based turfgrass)
23,842,324 gal is the total water use for a 1 season.

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Cost Example

Determine the cost of water for 1 season.

D. Costs: The cost of water is based on a charge of $0.03/ft³. Determining the total cost requires one more conversion factor.

1) $$\frac{1\ ft^3}{7.480519\ gal} = \frac{X\ ft^3}{23{,}842,\ 324\ gal}$$

2) $X\ ft^3 = 23{,}840{,}643 \div 7.480519$

3) $X = 3{,}187{,}030\ ft^3$

At $0.03/ft³, the total cost of water is estimated to be:

4) $X = (3{,}187{,}030)(0.03)$
$X = \$95{,}610.91$

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Pesticide Calculations

Practical problems involving active ingredients.

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Active Ingredient Formulations

- Percent active ingredient (A.I.) will be listed on the container.
  - Dry pesticide formulations
    - Dusts (D)
    - Granules (G)
    - Dry Flowables (DF)
    - Water Dispersible Granules (WDG)
    - Wettable Powders (WP)
    - Soluble Powders (SP)

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Active Ingredient Formulations

- Percent active ingredient (A.I.) will be listed on the container.
  - Liquids:
    - Emulsifiable Concentrates (EC)
    - Solutions (S)
    - Liquids (L)
    - Flowables (F)

- Concentration of the active ingredient is usually listed immediately in front of the formulation abbreviation (i.e. 3EC, 2L, 4F).
- The number indicates the pounds of active ingredient contained in one gallon of product
  - (i.e. 3 EC would mean that the product was an emulsifiable concentrate containing 3 pounds of active ingredient per gallon).

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Dry pesticides are worked like dry fertilizers

Liquid pesticides are worked like liquid fertilizers

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A 2.5G preemergence herbicide is to be applied at a rate of 2 lbs. a.i. per acre to 90,000 ft^2 of fields. How much of the material will be needed?

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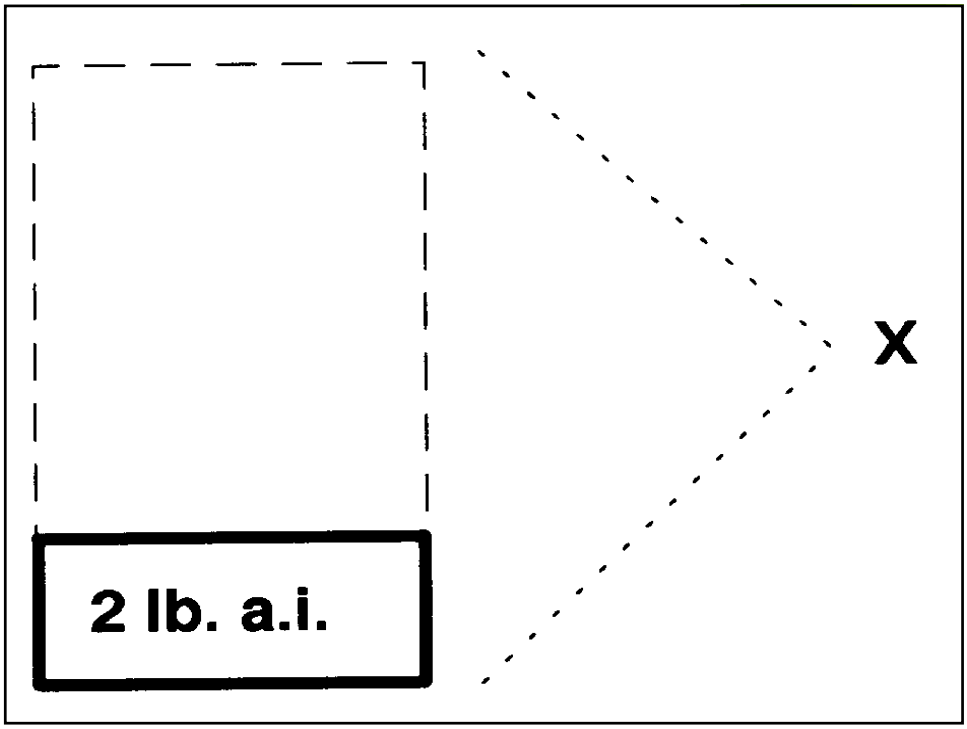

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1) (X) (0.025) = 2 lbs. a.i.

2) X = 2 / 0.025

3) X = 80 lbs. of 2.5G per acre will be needed to apply 2 lbs. a.i. per acre

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How much 4 EC herbicide will be needed to apply 1.5 lbs. active ingredient (a.i.) per acre?

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$$\frac{1 \text{ gal.}}{4 \text{ lbs. a.i.}} = \frac{X}{1.5 \text{ lbs. a.i.}}$$

2) $X = \frac{1.5}{4}$

3) $X = 0.375$ gal.

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Questions???

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