

AE 340 Laboratory 8 Field Capacity

Question 1. Select any combine from the accompanying spreadsheet (or any other combine of your choice), with an appropriate corn head. The area you need to harvest per season is 1000 ha (2500 acres). The corn is yielding 15 Mg/ha (250 bushels/ac) and is in 800m ($\frac{1}{2}$ mile) rows. The maximum speed in the field is 8 km/h (5 mph), and average travel distance to the trucks for offloading is 400m ($\frac{1}{4}$ mile). The turn time at the end of field rows is 20 seconds. The combine travel speed to offload is 8 km/h (5 mph) when full or and 10 km/h (6 mph) when empty. A single 25000kg (1000 bu) grain wagon is available with the same travel speeds as the combine. The unloading rate of the wagon is 13000 kg/min (500 bu/min). A maximum of four, 25 tonne, (1000 bu) truck are available to move grain to the elevator which is 25 km (15 miles) from the field and the average speed of the truck is 50 km/h (30 mph). The unloading time at the elevator is 30 min.

Determine the Field Capacity, Effective Field Capacity and Field Efficiency under the following conditions.

- 1). The grain wagon is not used, and the combine unloads at the trucks. (For this ignore trucking time and assume that the trucks are capable of transporting all grain harvested.)
- 2). The grain wagon is used, and the combine unloads on the go. (For this ignore trucking time and assume that the trucks are capable of transporting all grain harvested.)
- 3). The grain wagon is used, and the combine unloads on the go.. Include the effect of transportation in this analysis.

Question 2. Given: The following data were collected from a sprayer operation while applying one tankful of solution. The boom of the sprayer covered a 33-foot swath.

<u>Event</u>	<u>Time min.</u>	<u>Event</u>	<u>Time min.</u>
Fill tank	20.6	Spray	3.70
Travel	1.3	Check nozzle	2.65
Spray	7.63	Spray	3.88
Turn	0.12	Turn	0.11
Spray	7.77	Spray	7.62
Turn	0.11	Turn	0.11
Spray	7.47	Spray	7.58
Turn	0.11	Turn	0.14
Spray	7.56	Spray	7.49
Turn	0.12	Travel	2.10
Unplug nozzle	1.21		

Determine:

- a) Percent of time turning.
Percent of time unplugging and checking nozzles.
Percent of time filling tank.
Percent of time actually spraying.
- b) Field speed in mph, if the field length is $\frac{1}{2}$ mile.
- c) Theoretical field capacity, effective field capacity, and field efficiency.

Question 2. Given: Field length and width = 1/4 mile. For a tillage operation the unproductive time is 2 min/acre, the effective swath width is implement width less 1 foot, and the turn time is 5 sec/turn.

Calculate: (show sample calculations for one particular case)

- a. For a speed of 4.5 mph, determine the theoretical field capacity (TFC), effective field capacity (EFC), and field efficiency (FE) for varying implement widths. Use 2-foot increments and at least 10 different widths. Graph TFC and EFC vs. Width.
- b. For an implement width of 16-feet, determine the theoretical field capacity (TFC), effective field capacity (EFC), and field efficiency (FE) for varying operating speeds. Use 0.5 mph increments and at least 10 different speeds. Graph TFC and EFC vs. Speed.

Graphs should include appropriate titles, labels, scales and units for axes, and data points.

Briefly comment on the results. How does implement width and speed affect theoretical field capacity, effective field capacity, and field efficiency? Should the goal of the machinery operator be to maximize theoretical field capacity, effective field capacity, and field efficiency? Explain.