

## Results and Discussion

### Application and Field Testing Phase

#### Task Analysis: Energy and Fuel Consumption

This section incorporates detailed task data, hours of operation, and energy efficiency metrics as follows:

<b>Task</b>	<b>Month</b>	<b>Hours Operated</b>	<b>Energy Used (kWh)</b>	<b>Fuel Used (gallons)</b>
<b>Spraying</b>	April	4	4.8	0.9
	May	2	2.4	0.5
	June	6	7.2	1.2
	July	4	4.8	1.0
	August	6	7.2	1.3
	September	2	2.4	0.4
<b>Trimming</b>	June	5	6.0	1.2
	July	8	9.6	2.0
	August	2	2.4	0.5
<b>Raking</b>	June	7	8.4	1.8
	July	5	6.0	1.5
	August	3	3.6	0.9
	September	1	1.2	0.3
<b>Fertilizer Spreading</b>	April	4	4.8	0.9
	May	10	12.0	2.5
	June	3	3.6	0.8
	July	1	1.2	0.2
	August	1	1.2	0.2
	September	1	1.2	0.2

## Solar Energy Integration

Data highlights the balance of solar energy production and tractor energy consumption:

- **Spraying (April):** Daily solar production exceeded task energy demand. (*Image: Field Spraying*)



- **Trimming (June):** Solar energy fully supported task operations on sunny days. (*Image: Fence Line Trimming*)



- **Raking (July):** Required supplemental grid energy due to high load and cloudy days.  
(Image: **Raking Hay**)



#### 4.1. Spraying Liquid Fertilizer

- **Description:** Tractor pulled a sprayer loaded with 250 gallons of liquid. The task required pulling and minimal pump energy.
- **Electric Consumption (kWh):**

Month	Hours Operated	Total Energy Consumed (kWh)
April	4	4.8
May	2	2.4
June	6	7.2
July	4	4.8
August	6	7.2
September	2	2.4

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#### 4.2. Trimming Fence Lines

- **Description:** Fence trimming using a three-point-mounted string trimmer. Task primarily required propulsion power.
- **Electric Consumption (kWh):**

Month	Hours Operated	Total Energy Consumed (kWh)
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June	5	6.0
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July	8	9.6
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August	2	2.4
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#### 4.3. Raking Hay

- **Description:** Raking hay to form windrows. Required high pulling force but no PTO.
- **Electric Consumption (kWh):**

Month	Hours Operated	Total Energy Consumed (kWh)
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June	7	8.4
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July	5	6.0
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August	3	3.6
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September	1	1.2
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#### 4.4. Fertilizer Spreading

- **Description:** Spreading granular fertilizer using a tow-behind spreader.
- **Electric Consumption (kWh):**

Month	Hours Operated	Total Energy Consumed (kWh)
April	4.0	4.8
May	10.0	12.0
June	3.0	3.6
July	1.0	1.2
August	1.0	1.2
September	1.0	1.2