RESEARCH UPDATE: DUAL-USE SOLAR

PAC MEETING
MARCH 13, 2023

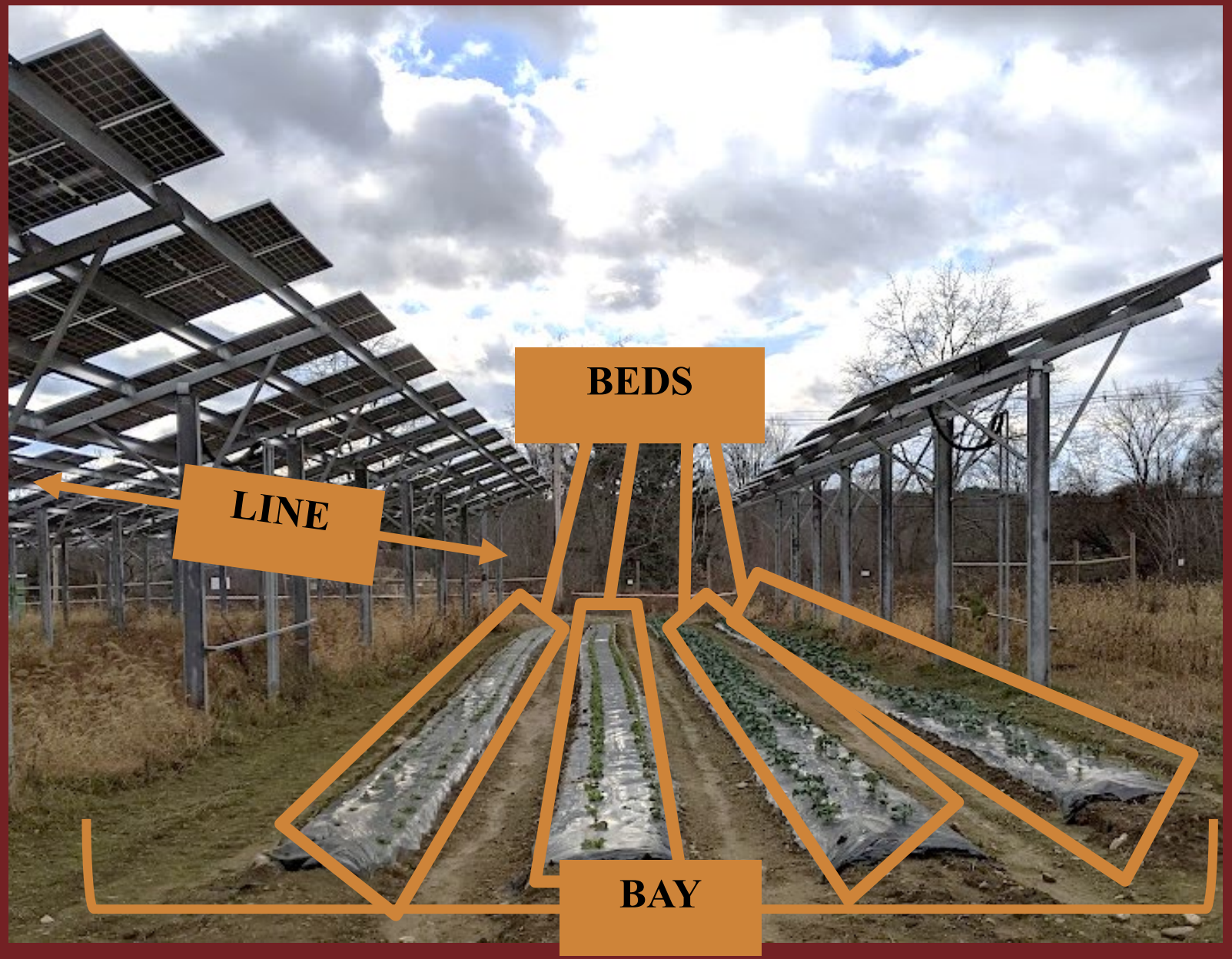
U.S. DEPARTMENT OF ENERGY
Solar Energy Technologies Office DE-EE0009374

UPDATES

- Completed 5 months of field testing of sensors
    - July 2022 – November 2022
- Adding additional sensors in 2023 to increase data collection
- Updated experimental designs
- Conducting farmer/researcher meetings to prepare 2023 field operations plans

SENSOR MEASUREMENTS & SITES

- Light duration and intensity
- Rainfall
- Leaf wetness
- Soil moisture and temperature
- Ambient temperature and humidity
- One site with butternut and lettuce
- One site with pasture
- One site with hay


BEDS
LINE
BAY

QUESTION DEVELOPMENT (EXAMPLE ONE)

How do solar panels alter temperature in an agricultural field? How does this affect crop growth?

BIG PICTURE

Are there fewer, total growing degree days in a solar array compared to a field without a solar array?

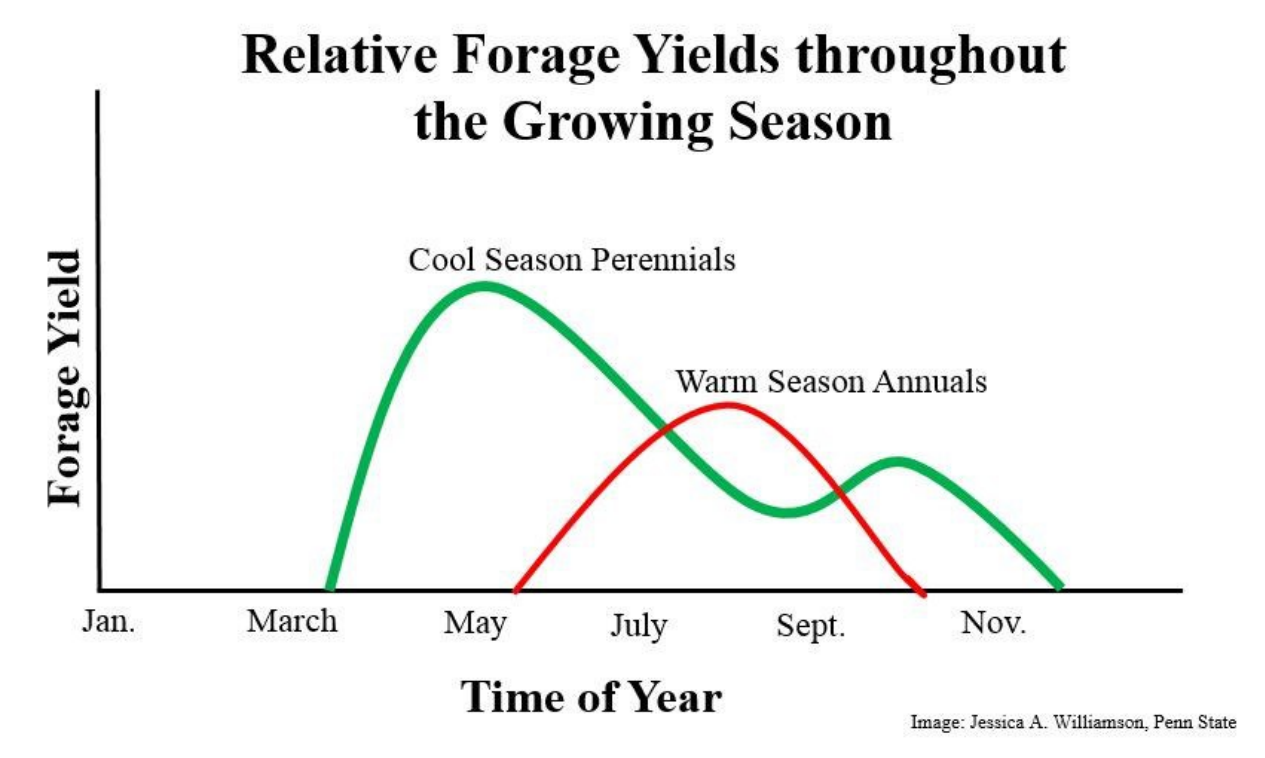
GDD = [(Max. daily temp – Min. daily temp)/2]-Base Temperature

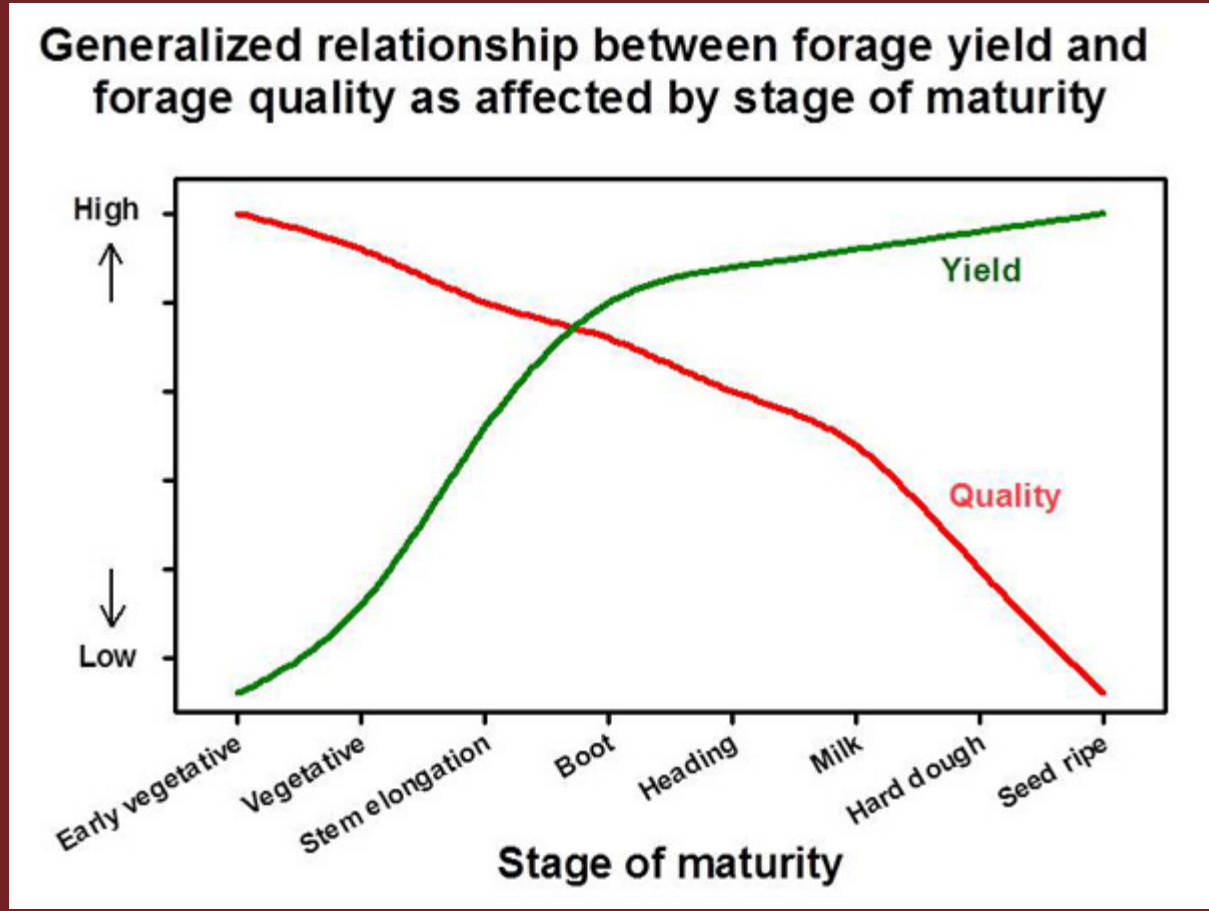
Base Temp = min. temp for growth; crop specific, 32 or 50ºF

ARRAY TO CONTROL COMPARISON

Do growing degree days accumulate at different rates in each bed? If so, is this significant enough to result in harvest date differences?

LOCATION SPECIFIC VARIATION


Relative Forage Yields throughout the Growing Season
Forage Yield
Cool Season Perennials
Warm Season Annuals
Jan.
March
May
July
Sept.
Nov.
Time of Year
Image: Jessica A. Williamson, Penn State


Generalized relationship between forage yield and forage quality as affected by stage of maturity
High
Low
Yield
Quality
Early vegetative
Vegetative
Stem elongation
Boot
Heading
Milk
Hard dough
Seed ripe
Stage of maturity

QUESTION DEVELOPMENT (EXAMPLE TWO)

How do solar panels alter temperature in an agricultural field? How does this affect crop growth?

BIG PICTURE

If temperatures in the array are reduced, is this enough to offset the summer slump response of hay and pasture grass?

PHYSIOLOGY & YIELD

If temperatures changes offset summer slump in the array, is there any trade off in forage quality between less, sun grown grass and more, shade grown grass?

PHYSIOLOGY & QUALITY