

# Primary Productivity Report

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⊕ **AIMS** → The experiment's primary goal was to measure the gross primary productivity (GPP), net primary productivity (NPP), and respiration rate (RR), of *Baobab* plants in a controlled environment.

⊕ **THEORY** →

⊙ **Net primary productivity (NPP)** : NPP is the net amount of carbon stored in plant biomass after respiration losses. We calculated by subtracting the plant respiration and various losses (like root turnover and exudation) from the GPP.

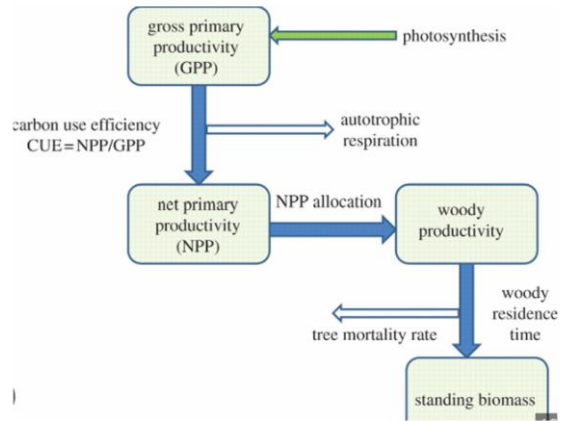
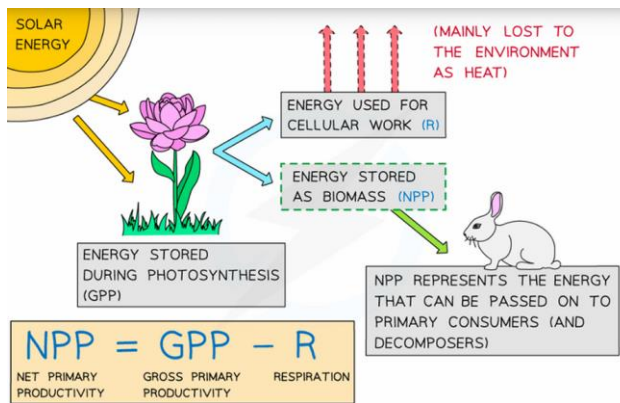
NPP is the key metric to determine the energy available for plant growth and for consumption by herbivores and decomposers in the ecosystem.

⊙ **Gross primary productivity (GPP)** : It represents the total organic matter produced by plants via photosynthesis. Mathematically, GPP can be seen as the sum of organic matter synthesized plus the respiration rate and any metabolic losses.

⊙ **Respiration Rate** : Respiration is the process on which plants breakdown carbohydrates, typically derived from photosynthesis, to release energy for cellular processes.

The relationships between these parameters as follows,

$$NPP = GPP - RR$$



## ⊕ MATERIALS REQUIRED

- ① POTS
- ② Barley seed
- ③ clay soil
- ④ petri dish
- ⑤ water
- ⑥ weighing scale
- ⑦ oven for plants drying
- ⑧ spoon
- ⑨ light source
- ⑩ Aluminium foil.

## ⊕ METHODOLOGY

### (A) Preparing pots and seeding

(1) Pot setup: Nine pots were filled with clay soil and placed in a controlled environment to ensure consistent growth.

(2) Seeding: Each pot was sown with 15 barley seeds. The pots were left undisturbed for five days, allowing the seeds to germinate and establish the growth.



### (B) Initial Biomass measurements (Day 5)

After 5 days, three pots were selected, and the plant from each pot were carefully uprooted, washed, and weighed to record initial mass.

### (C) Light treatment and growth conditions:

→ The remaining six pots were divided into two groups: light-exposed group, which placed in placed in direct sunlight and light-restricted group, which were covered with aluminium foil to block sun-light. All pots were kept in these conditions for an additional 10 days, with regular monitoring.





(c) Final Biomass measurement (Day 15)  
 On the 15th day, plants from all pots were collected, washed, dried and weighed to record the final biomass, which allowed for the calculation of productivity and respiration metrics over the experiment's duration.



#### ⊕ OBSERVATIONS AND CALCULATIONS

##### Experimental data

- Diameter of pot : 12cm (0.12m)
- Area of each pot : calculated as  $\pi \times r^2$   
 $\Rightarrow 0.0113 \text{ m}^2$

##### calculation,

- NPP (Net primary productivity) :

$$\Rightarrow \frac{\text{Avg. Biomass at day 15} - \text{Avg. Biomass at Day 5}}{\text{Area} \times \text{Duration (days)}}$$

Area  $\times$  Duration (days)

- RR (Respiration Rate) :

$$\Rightarrow \frac{\text{Avg. uncovered biomass} - \text{Avg. covered biomass}}{\text{Area} \times \text{Duration (days)}}$$

	Total biomass	Group 4
Time (Biomass after)	Wet weight(g)	Dry Weight(g)
5 days	0.104	0.0227
15 days(without light)	0.1397	0.0324
15 days(with light)	0.1523	0.0416

substituting values,

$$\rightarrow NPP = \frac{(0.1397 - 0.0416) - (0.104 - 0.0227)}{10 \times 0.0118}$$

$$NPP = 0.2602 \text{ g/d.m}^2$$

$$\rightarrow RR = \frac{(0.1523 - 0.0416) - (0.1397 - 0.0324)}{10 \times 0.0118}$$

$$RR = 0.03 \text{ g/dm}^2$$

gross.

$$\rightarrow GPP = NPP + RR$$

$$= 0.2602 + 0.03$$

$$= 0.2902 \text{ g/d.m}^2$$

## ⊕ RESULTS,

$$NPP = 0.2602 \text{ g/d.m}^2$$

$$RR = 0.03 \text{ g/d.m}^2$$

$$GPP = 0.2902 \text{ g/d.m}^2$$

## ⊕ CONCLUSION:

The ~~experiment~~ experiment concluded that GPP measured the total energy captured by barley plant through photosynthesis, while NPP represents the energy available for growth and consumption by other organisms after subtracting respiration losses.

These metrics highlight the essential role of sunlight in boosting plant productivity and provide insight for sustainable agriculture and ecosystem management by identifying the energy available to support life within the ecosystem.