



# Use of *Panicum maximum* as a Source of Bio-fertilizer and Biochar on Crop Response of *Raphanus sativus* L. in Organic Cultivation



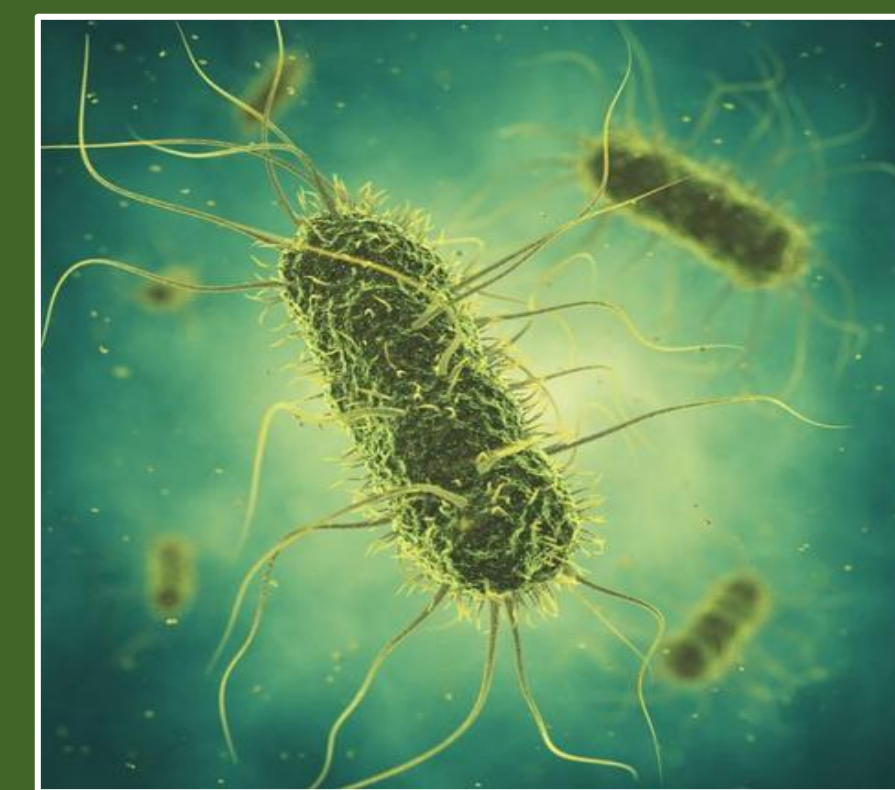
## PROBLEM

*Panicum maximum* (Guinea grass/ Buffalo grass) is a ubiquitous perennial weed that classified as an invasive species in Sri Lanka.

- Fast growth and spread by seeds and underground stem parts
- Grow up to about 2 m in height
- Drought tolerant
- Difficult to control



Symbiotic Association



### PGPR

- Free living
  - Nitrogen fixing
- Eg. Azospirillum

## MATERIALS & METHODS

- The experiment was conducted as a pot trial in a polytunnel of Wayamba University of Sri Lanka from June to September 2017. (Black colour poly bag with 38 cm length\*22 cm diameter).

Radish - Short term crop  
Variety – *Beeralu Rabu*  
Harvesting time – 45-50 days  
Yield (with inorganic Fertilizer) = 20-30 t/ha



### Preparation of Bio-fertilizer

#### Bio-fertilizer A – Root Pieces

100 grams of fresh roots of well-established flowering *P. maximum* (Guinea grass) were cut into about 1 cm pieces and mixed with soil potting mixture (per plant) 24 h before sowing seeds.

#### Bio-fertilizer B – Root Solution

100 grams of fresh roots of well-established flowering *P. maximum* were shaken in 200 ml water for 5 minutes (per plant). It was applied on the soil surface 24 h before seed sowing and continued weekly.

### Preparation of Biochar

Well established flowering *P. maximum* plants were uprooted and dried

cut in to (about 15 cm) pieces

Two different sized metal barrels were used. Dried grasses were loaded into smaller barrel and closed it with the lid

It was placed in large barrel and dry hardwood were filled in the space between the two barrels and set fire to it.

After complete pyrolysis process, it was left to cool overnight

### Experimental Design

Randomized Complete Block Design (RCBD) with six treatments and three replicates. Each replicate contained four plants.

### Statistical Analysis

Analyse the data using SAS Statistical software (version 9.4)

## SOLUTION

### Bio-fertilizer



### Biochar



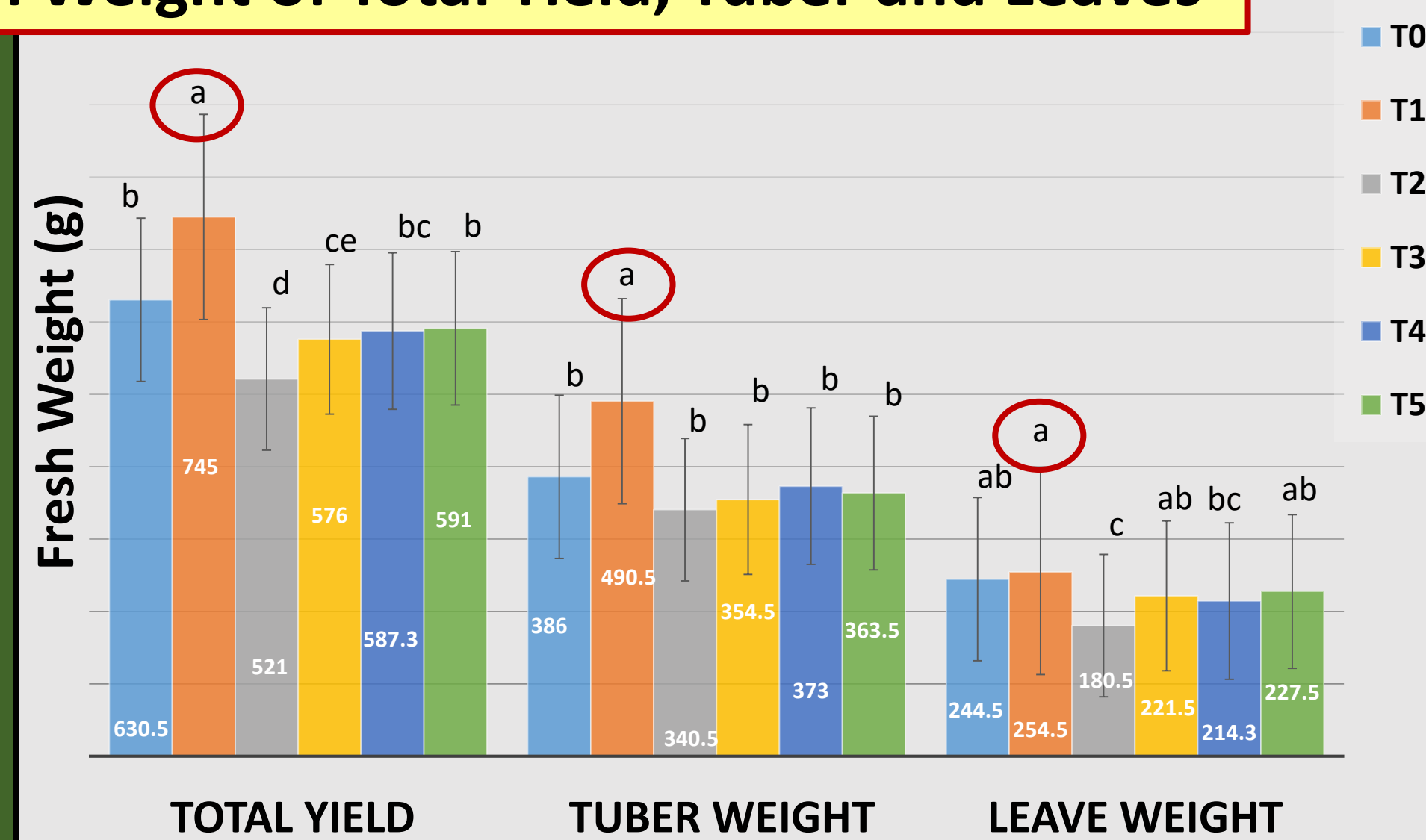
Code	Treatment Combinations
T <sub>0</sub>	Control
T <sub>1</sub>	Bio-fertilizer A (Root Pieces; 100 g /per plant)
T <sub>2</sub>	Bio-fertilizer B (Root Solution; 200 ml /per plant)
T <sub>3</sub>	Biochar (38 g /per plant)
T <sub>4</sub>	Biochar (38 g /per plant) + Bio-fertilizer A (Root Pieces; 100 g /per plant)
T <sub>5</sub>	Biochar (38 g /per plant) + Bio-fertilizer B (Root Solution; 200 ml /per plant)

## RESULTS

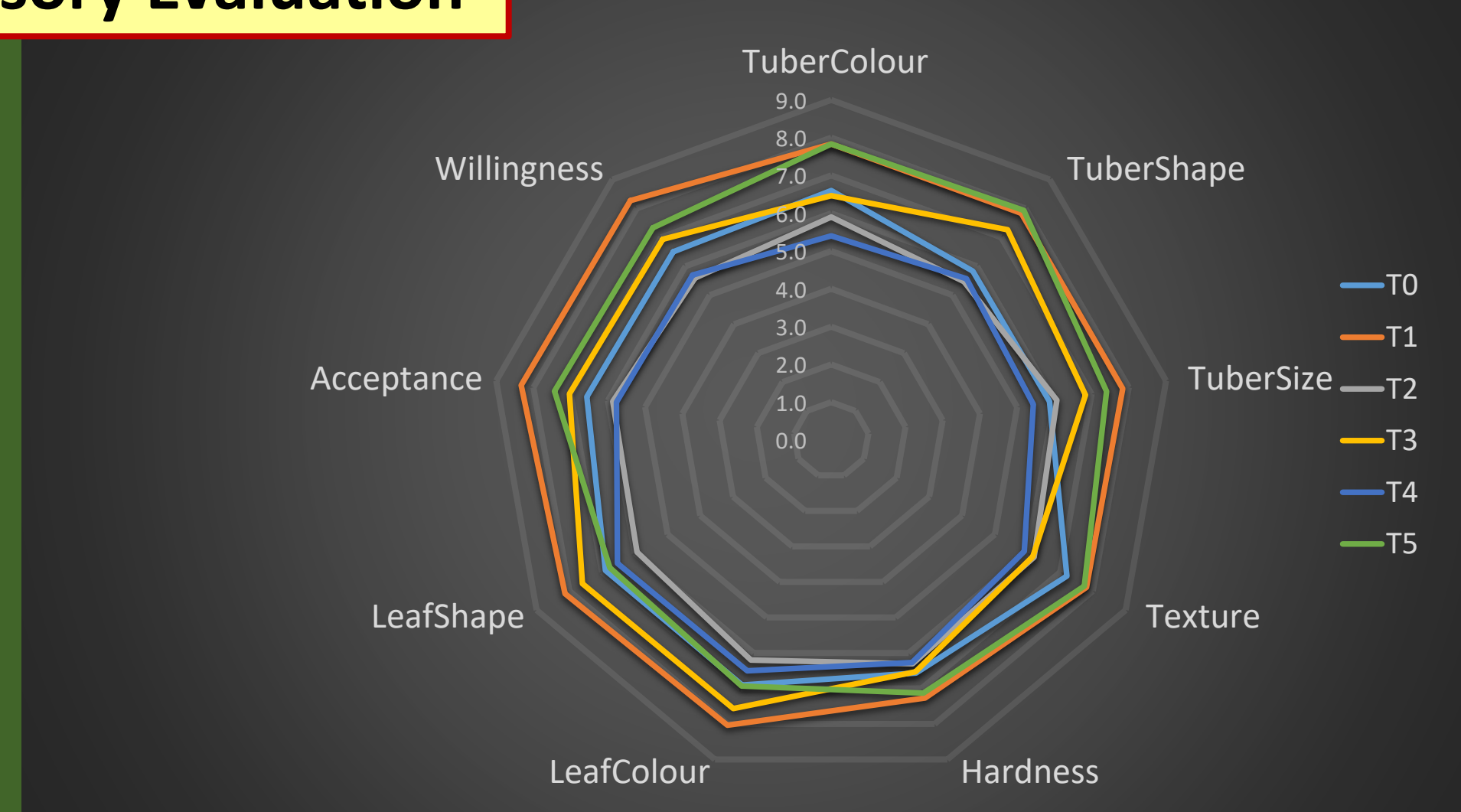
### Number of Leaves

Treatments	Number of Leaves		
	20 DAG(Days After Germination)	30 DAG	40 DAG
T <sub>0</sub>	4.50 <sup>a</sup>	7.17 <sup>b</sup>	10.17 <sup>b</sup>
T <sub>1</sub>	5.33 <sup>a</sup>	9.08 <sup>a</sup>	12.17 <sup>a</sup>
T <sub>2</sub>	4.17 <sup>a</sup>	7.08 <sup>c</sup>	8.75 <sup>d</sup>
T <sub>3</sub>	4.42 <sup>a</sup>	7.58 <sup>b</sup>	10.92 <sup>b</sup>
T <sub>4</sub>	4.91 <sup>a</sup>	7.83 <sup>bc</sup>	10.58 <sup>b</sup>
T <sub>5</sub>	4.58 <sup>a</sup>	8.08 <sup>b</sup>	11.50 <sup>c</sup>
P	0.1621	0.0081	0.0231

### Fresh Weight of Total Yield, Tuber and Leaves



### Sensory Evaluation



### Vegetative Parameters

- Number of Leaves
- Canopy Height
- Chlorophyll Content

### Yield Parameters

Harvesting was carried out 46 days after seed sowing

- Weight of the Total Yield
- Weight of the Tuber
- Weight of the Leaves

### Quality Parameters

#### Sensory Evaluation

- Carried out immediately after harvesting.
- Included six samples from six treatments.
- Reviewed by 30 respondents.
- Used 9- point hedonic scale.

Yield of T<sub>1</sub> (Bio-fertilizer A; Root pieces without biochar) = 27.3-27.9 t /ha

## CONCLUSIONS

- Root pieces of *P. maximum* can be used as a **source of bio-fertilizer** to enhance the vegetative growth, yield and quality of radish in organic agriculture with which dispersion of *P. maximum* can be controlled.
- *P. maximum* root based bio-fertilizer is a **simple, island wide available, easy to prepare in the field and low cost** solution for rural farmers to promote the organic agriculture in Sri Lanka.
- Adding biochar produced by barrel method did not make any significant improvement for the crop growth probably due to the failure of providing expected temperature range for biochar preparation.

Further studies are necessary,

- To evaluate this biofertilizer in the field conditions with different weather conditions and soil types before recommending for farmers.
- To test the quantity of bio-fertilizer for best performance for each crop.
- To develop low cost microbial growth promoting soil additives to activate the microbial population associated with *P. maximum* root pieces.

## REFERENCES

- Alexander, M. and Blooms, B.R. (eds) (2000). Encyclopedia of Microbiology, Academic Press, London, 497-498.
- Dobbela, S., Croonenborghs, A., Thys, A., Placsek, D., Dutto, P., Gonzalez, C.L., Mellado, J.C., Aguirre, J.F., Kapulnik, Y., Brenner, S., Kadouri, D. and Okon, Y. (2001). Responses of agronomically important crops to inoculation with *Azospirillum*. *Australian Journal of Plant Physiology*, 28(3), 871-879.
- Weerawardane, N.D.R. and Dissanayake, J. (2005). Status of forest invasive species in Sri Lanka, *Proceedings of the Asia-Pacific Forest Invasive Species Conference*, 114-120.

