

Performance and Effects of Pine Harvesting Residue Treatment Methods in South Africa



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OUTLINE

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INTRODUCTION

- Wood product demand will increase from 2,3 to 3,1 billion m³ between 2020 and 2050
- Significance of silviculture in forestry
- Residue management as key component - burning (78%), broadcasting (11%)
mulching (8%)
- Lack of information relating to modern residue management methods

FAO (2022); Ramantswana et al, (2020)

RESEARCH GOAL & OBJECTIVES

The research goal is:

- The goal of this study was to determine the performance of three methods for dealing with harvest residues on pine stands

The research objectives are:

- Assess the operational productivity of three residue management methods (manual, semi mechanised, and fully mechanised)
- Assess the effectiveness of using the three methods in reducing fuel loads on various site conditions and costs
- Assess survival and early tree growth (1st year) response of *Pinus elliottii* plants growing on the different sites (broadcast and mulched)

MATERIALS AND METHODS

RESEARCH SITE

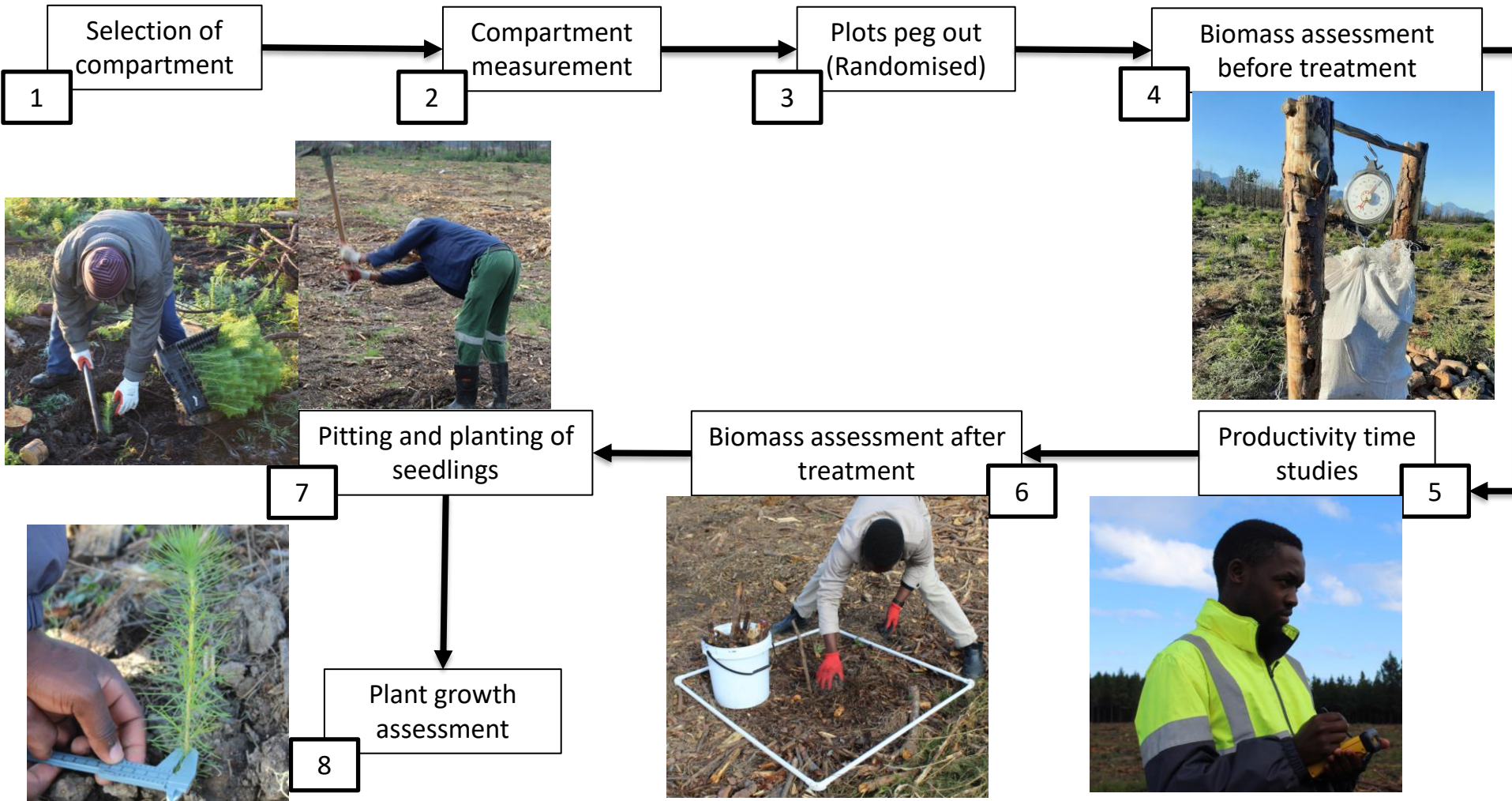


Figure 1: Study area

Table 1: Area information

Area information	Components
Compartment name	D57b
Co-ordinates	-33.972340, 23.692368
Effective area and Volume	10.41ha and 1031.15 m ³
Harvesting method used	Cut to length method

INVESTIGATIVE STEPS



LAYOUT OF PEGGED PLOTS

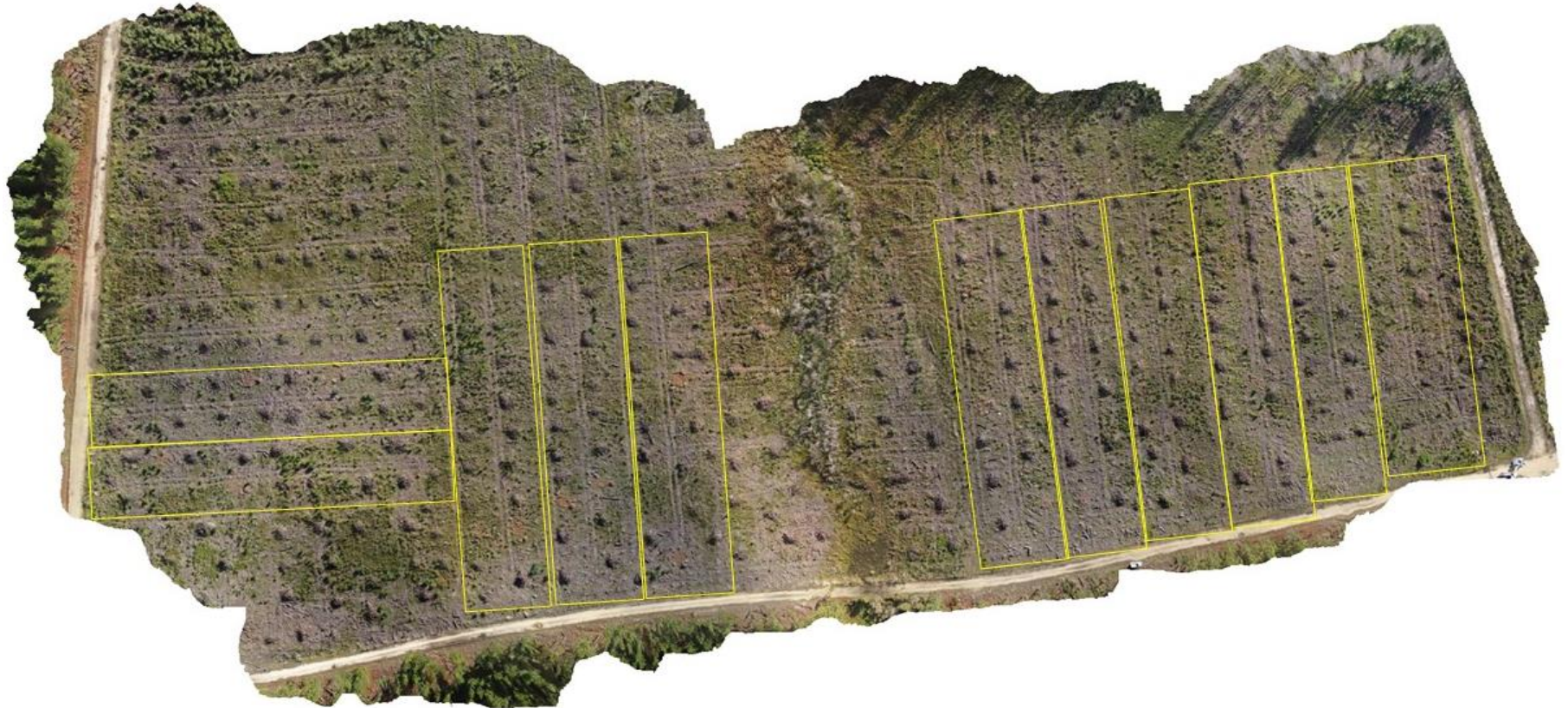


Figure 2: Pegged plots

METHODS & SPECIFICATIONS



Table 2: Machine Specifications

Specifications	Farm Tractor-Based Mulcher	Purpose-Built Mulcher
	<i>Carrier</i>	
Make and model	SAME Laser 110	Tigercat M726G
Engine power	74 kW (101 hp)	275 kW (370 hp)
Weight	8280 kg	14,880 kg
Ground clearance	450 mm	635 mm
Fuel tank capacity	320 L	570 L
	<i>Cutting head</i>	
Make and model	TMF200	Tigercat 4061-25
Type	Horizontal shaft	Horizontal shaft
Width	2441 mm	3000 mm
Mulching swath	2000 mm	2500 mm
Weight	1255 kg	4625 kg

Figure 3: Residue management methods

DATA ANALYSIS

- Descriptive statistics
- Statistica software package
 - Mann Whitney Test
- Costs calculated using the SAFCA costing model
- GenStat software package
 - Analysis of variance - One way ANOVA

RESULTS AND DISCUSSIONS

OBJECTIVE 1: STAND CHARACTERISTICS

Table 3: Descriptive statistics

Treatments	Broadcasting	Farm Tractor-Based Mulcher	Purpose-Built Mulcher
Hectares (ha)	0,42	0,45	0,4
No residue piles/plot	17	16	16
Residue load ODT/ha	14	12	14
% Stem wood	61	64	59

OBJECTIVE 1: PRODUCTIVITY RESULTS

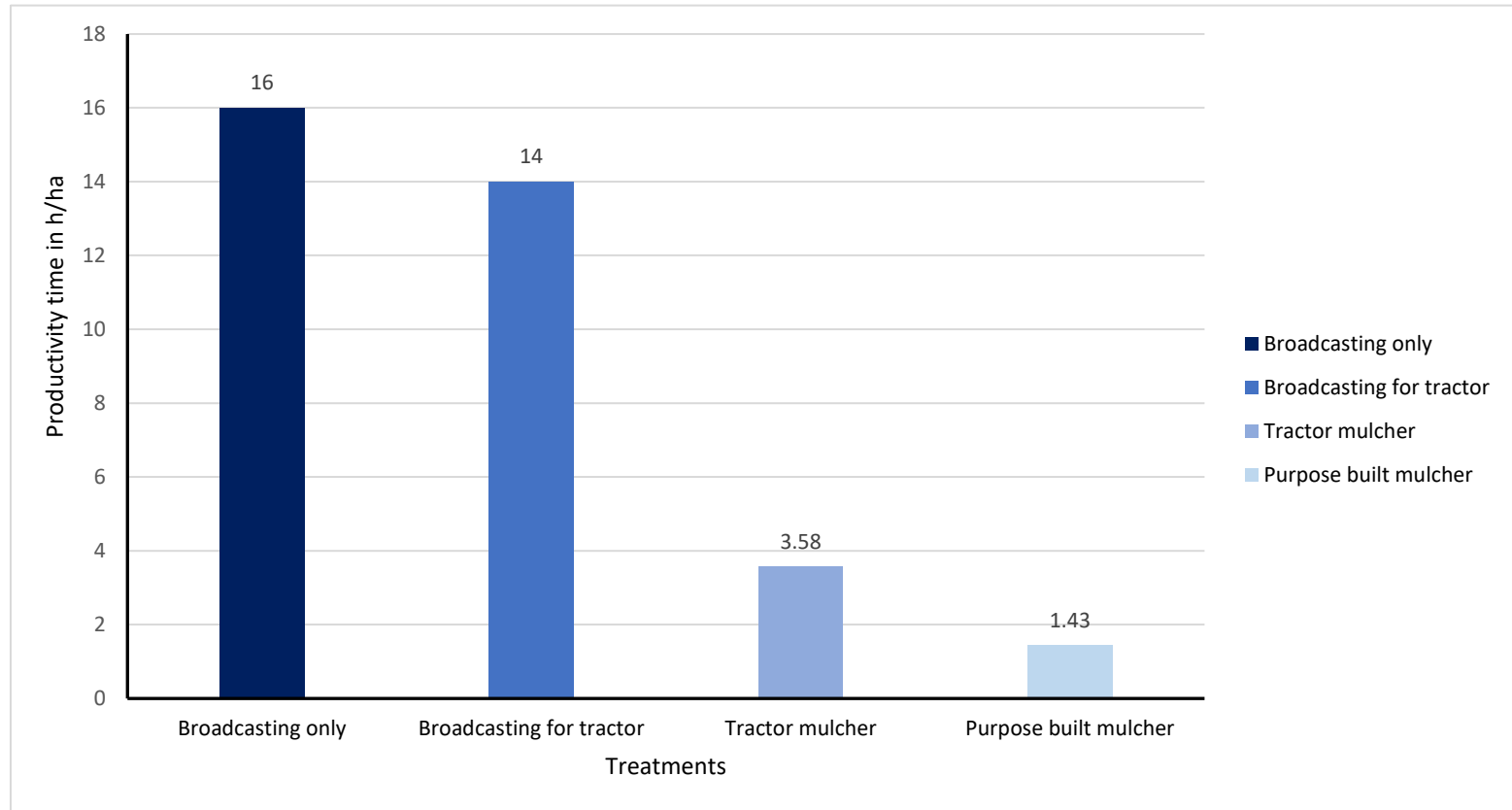


Figure 4: Productivity

OBJECTIVE 1: TREATMENT COST

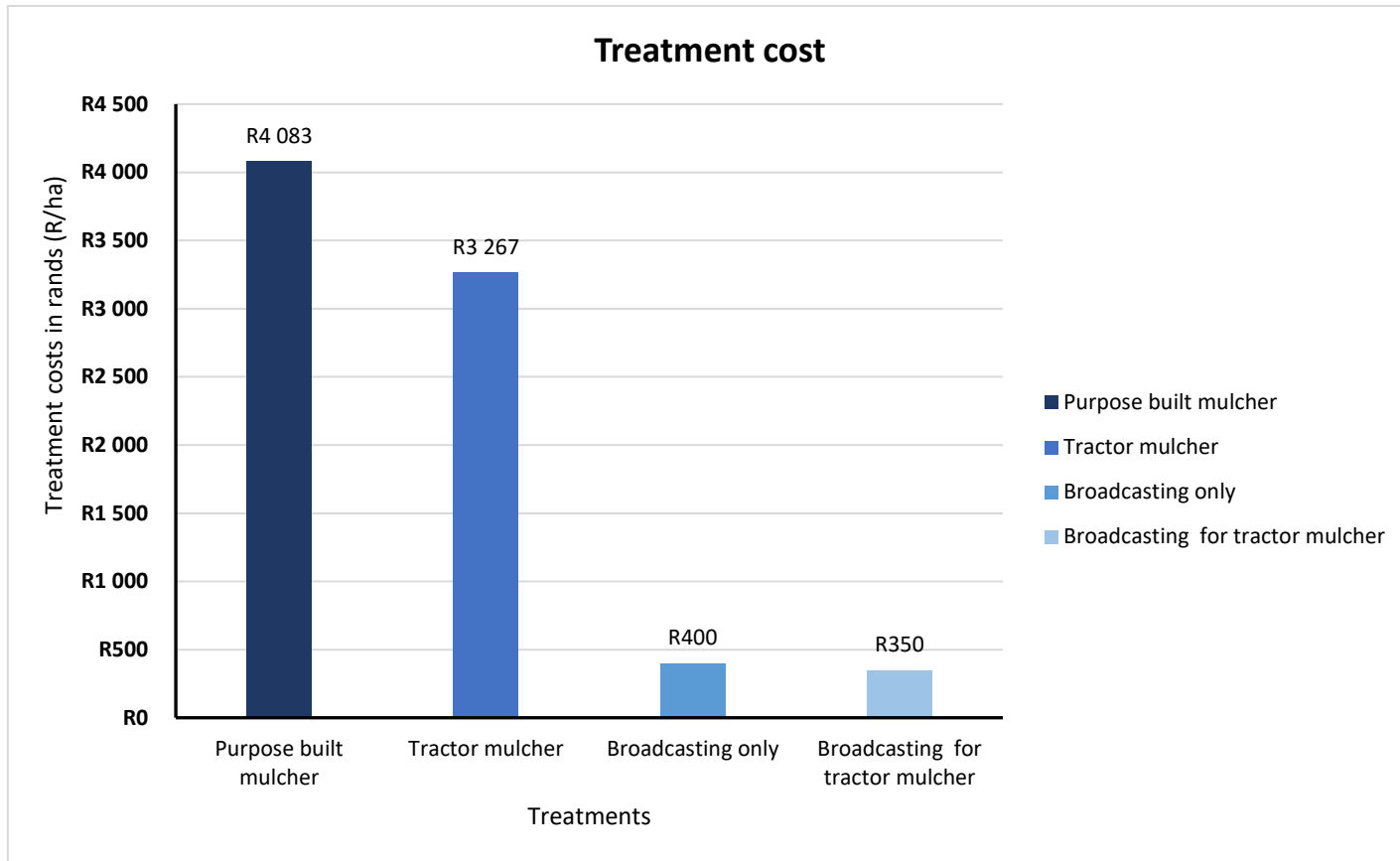


Figure 5: Costs

OBJECTIVE 2: RESIDUE BREAKDOWN BY METHOD

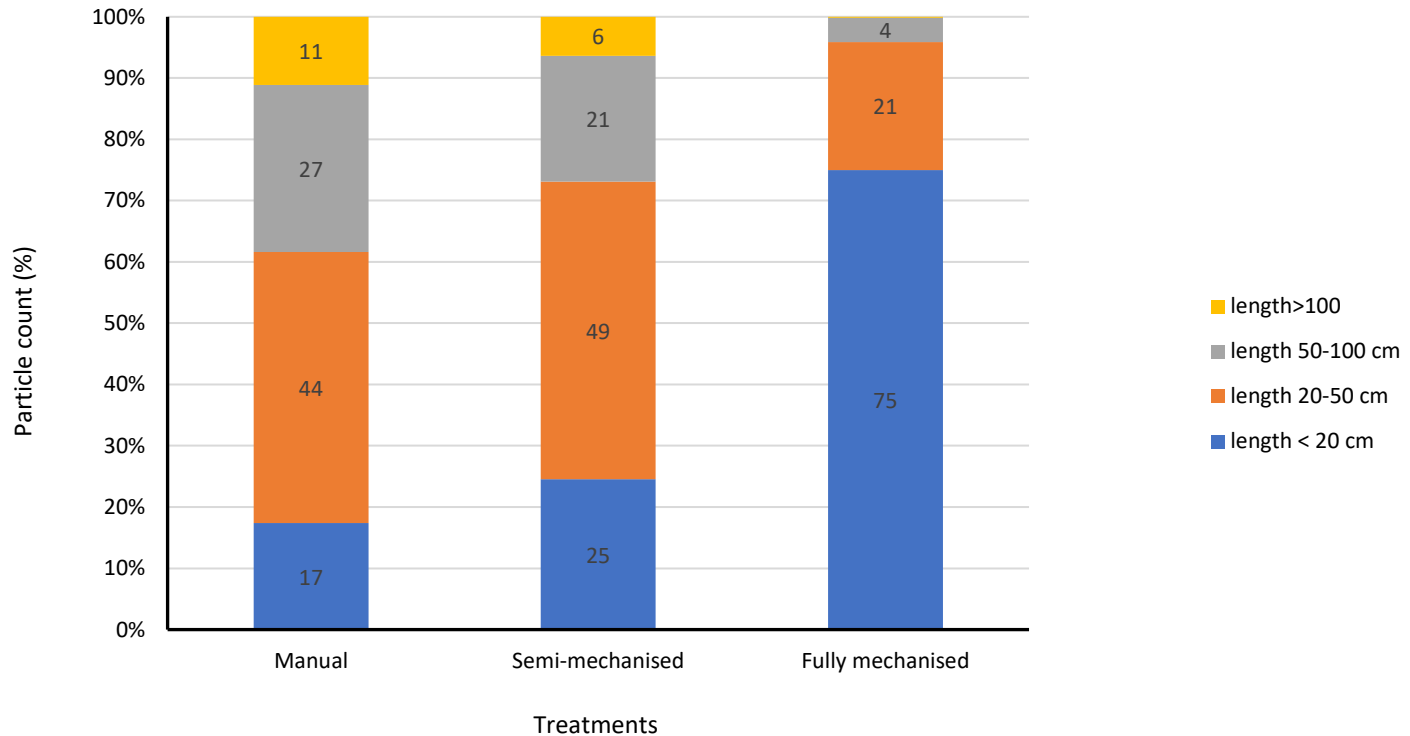


Figure 6: Residue breakdown

OBJECTIVE 3: HEIGHT GROWTH

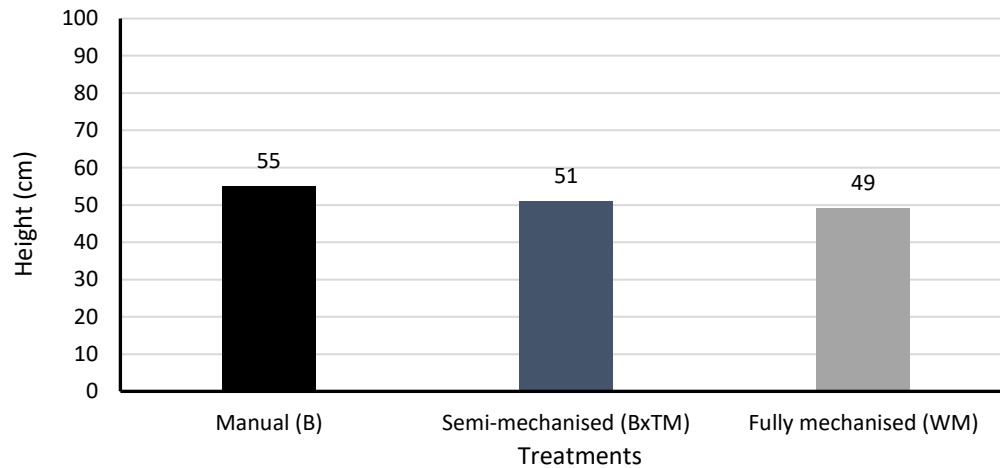


Figure 7: Six months height growth

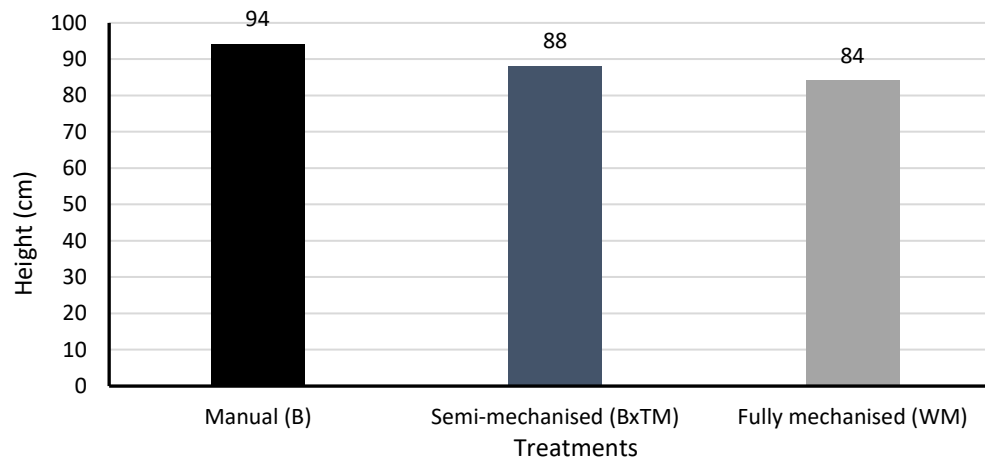


Figure 8: Twelve months height growth

OBJECTIVE 3: GROUND LINE DIAMETER

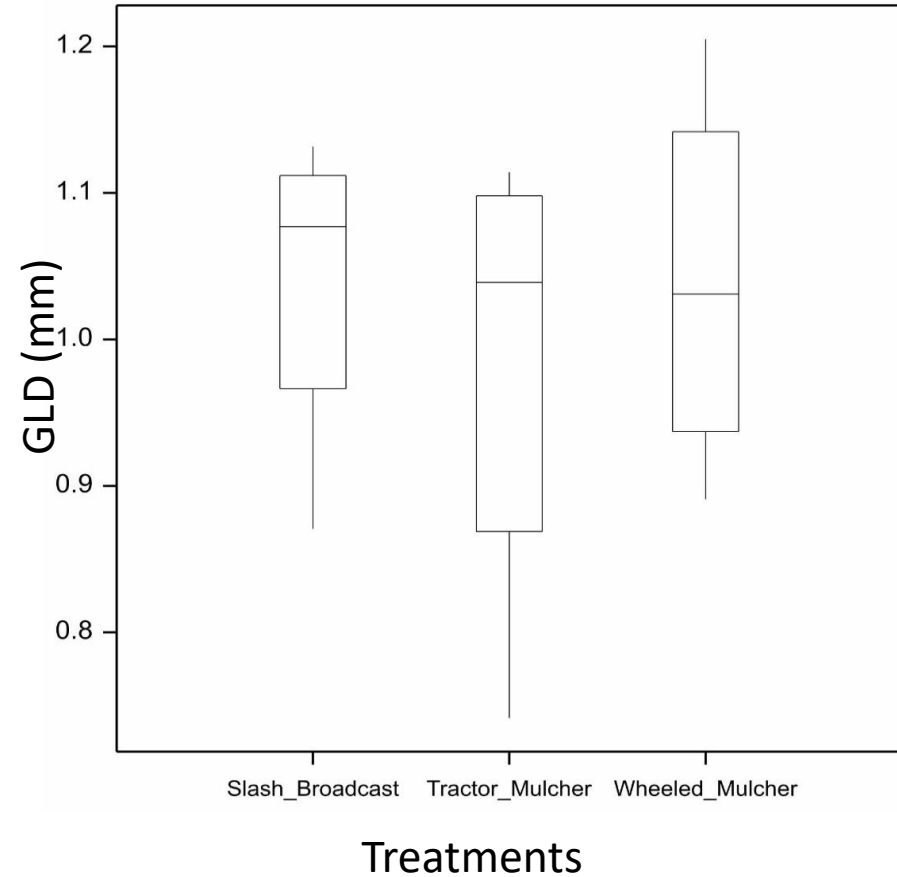


Figure 9: GLD in 6 moths

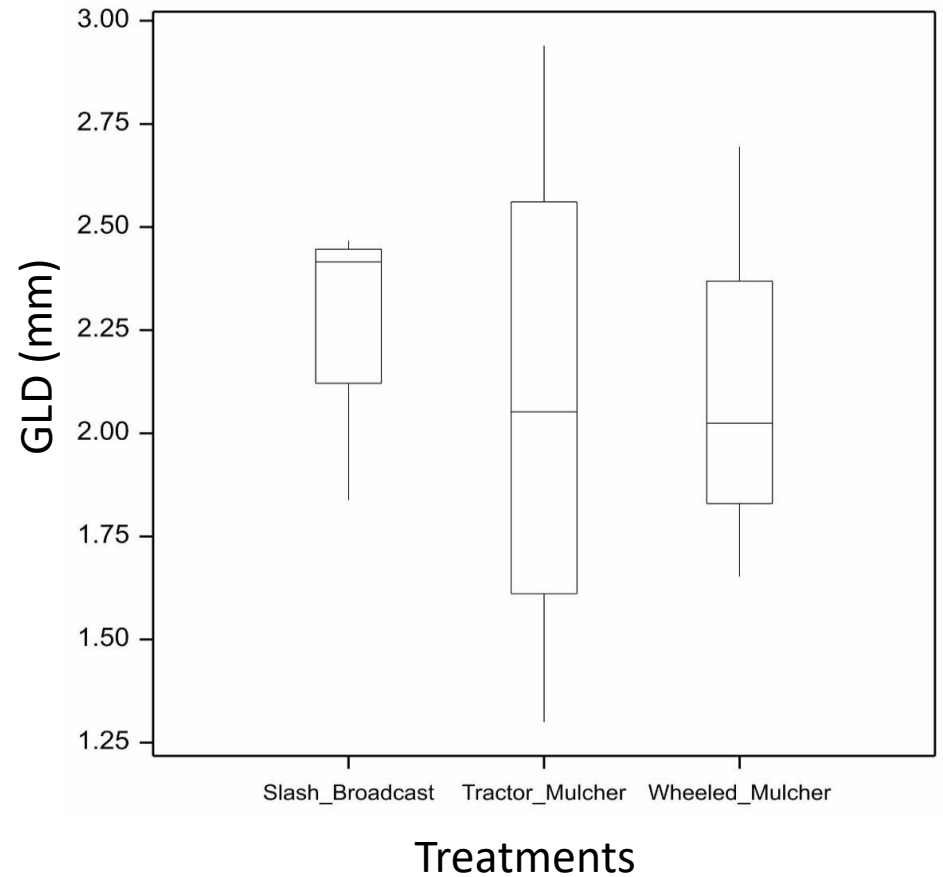


Figure 10: GLD in 12 moths

OBJECTIVE 3: SURVIVAL

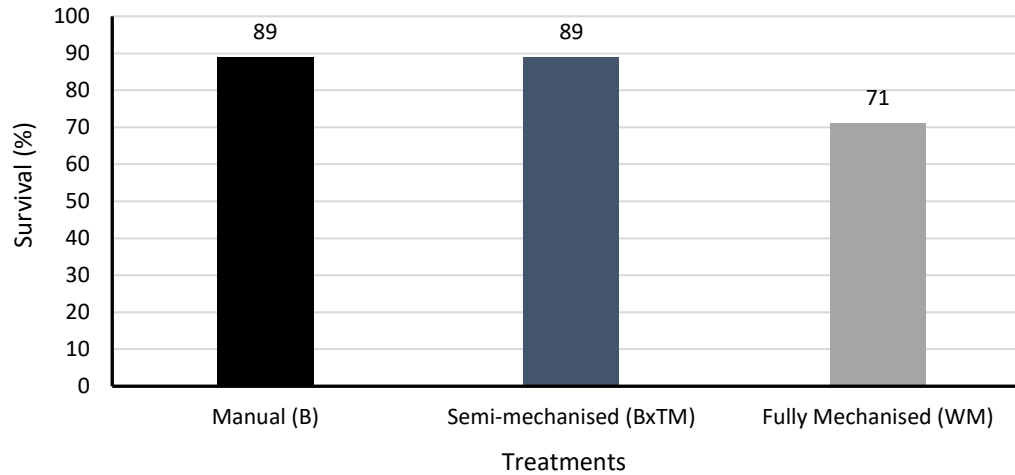


Figure 11: Survival in six months

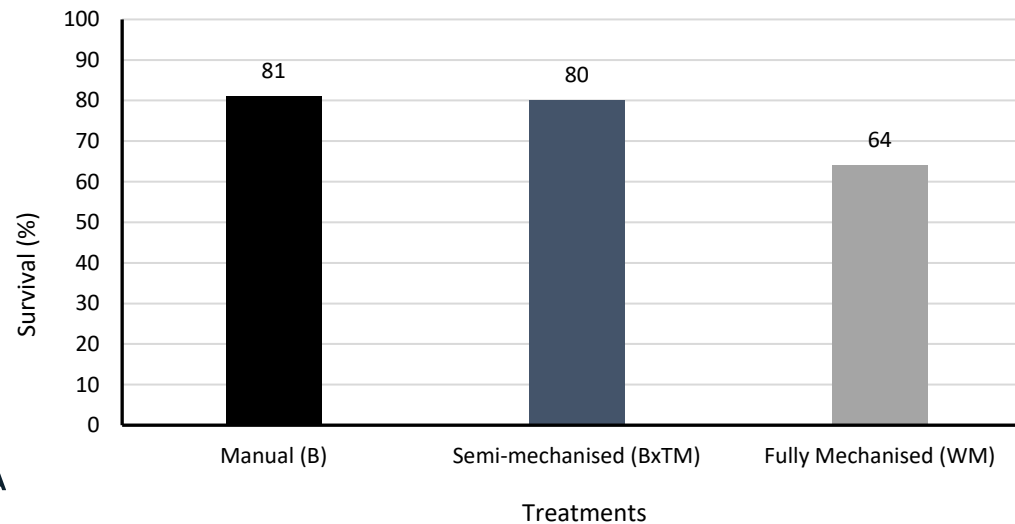


Figure 12: Survival in twelve months

CONCLUSION

- **Productivity and Cost**
 - Manual method – More time but cheap
 - Semi-mechanised method – More time and expensive
 - Fully mechanised method – Less time but expensive
- **Work quality**
 - Manual method – Least work quality
 - Semi-mechanised method – moderate work quality
 - Fully mechanised method – Best work quality
- **Growth and Survival (1st year)**
 - Manual method – Average mortality, good treatment
 - Semi-mechanised method – Average mortality, good treatment
 - Fully mechanised method – High mortality, worst treatment

RECOMMENDATIONS

Future studies must focus on:

- Investigate the impacts of work quality to determine how much of the additional cost incurred with mulching is recovered through more efficient replanting
- Researching on tractor and purpose-built mulching on other species (eucalyptus and acacia)
- Research could also look at alternative method for dealing with slash other than burning or mulching

REFERENCES

- FAO. Global Forest Sector Outlook 2050: Assessing Future Demand and Sources of Timber for a Sustainable Economy—Background Paper for The State of the World’s Forests 2022; FAO Forestry Working: Rome, Italy, 2022.
- Ramantswana, M.M.; Brink, M.P.; Little, K.M.; Spinelli, R.; Chirwa, P.W. Current status of technology-use for plantation re-establishment in South Africa. *South. For. J. For. Sci.* 2020, 82, 313–323.

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Thank you

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