

ADVANTAGES AND DISADVANTAGES OF WIDE TYRES ON SKIDDERS  
THE N.Z. WIDE TYRE SKIDDER TRIAL

<sup>my</sup>  
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Wide Tyre Skidder Trial

**SUMMARY**

The N.Z. trial objectives were to evaluate the performance of wide tyres on a conventional skidder with particular emphasis to comparisons of advantages and disadvantages of wide versus narrow tyres. These trials were conducted in clearfelling and one thinning harvesting operations on a variety of soils and terrain types in the North Island.

Administration and overall co-ordination was the responsibility of the Logging Industry Research Association (LIRA).

Funding for the trial was by the major contributors; N.Z. Forest Service (F.S.), N.Z. Forest Products (N.Z.F.S.), Tasman Forestry (Tas. Forestry), as well as minor contributors Henderson & Pollard (H. & P.) and the Dunedin City Council (D.C.C.).

Research was conducted by the Forest Research Institute (F.R.I.) and LIRA.

The machine used was a John Deere 540D skidder equipped with standard tyres (23.1-26 10 PR LS2) plus five wide high flotation tyres (66 x 43-25 10 PR).

Production levels have been high considering the size of the machine. Production levels approximated 200 m<sup>3</sup>/8 hr day, excluding the thinning trial, on both wide and narrow configurations.

Overall analysis is still to be completed which will be the preserve of the contributing companies.

To date the major advantages of wide tyres have not been as definite as indicated by overseas research.

Unfortunately the trial has been affected by abnormal dry weather conditions while at forests with clay soils.

**BACKGROUND**

Research conducted by the Forest Engineering Research Institute of Canada (FERIC) on skidders equipped with wide tyres in 1979, indicated the following advantages :

1. Productivity increases up to 60% in wet conditions, also lesser though significant improvements in performance on rough and steep terrain.
2. Fuel savings per unit volume up to 40%.
3. Substantial reductions in ground disturbance.
4. Less soil compaction.
5. Improved stability.
6. Improved operator comfort.

Disadvantages :

1. Higher price of wide tyres.
2. Increased stress on axles and final drives.
3. Additional width affecting machine manoeuvrability.
4. The unknown life of the tyres.
5. Rim slippage can be a problem.

**TRIAL OBJECTIVES**

The objective is to evaluate the performance of a conventional skidder equipped with wide tyres. The trial period was for 10 months from September 1985 to June 1986.

Specific objectives : Wide and narrow tyres

(i) Research Trials - to test impact on the soils :

- compaction
- rutting depth
- wheel slip under controlled conditions
- traction testing

(ii) Performance Monitoring :

- productive capability of machine (long term)
- climbing and sideslope ability including winching
- fuel usage
- overall cost

(iii) Production Studies - intensive studies to establish production levels, mechanical availability, machine utilisation, causes of delay.

**THE MACHINE**

Tenders were advertised to supply a suitable skidder equipped with standard plus associated set of wide tyres.

Lees Industries offer of a John Deere 540D was accepted, the main reasons being :

- competitive price
- special modifications for wide tyre option such as heavy duty axles (S4), stronger axle housings, differential gears, pinion and planetary gears and bearings.

Machine Specifications :

- 70kw (94 hp) diesel 4 cyl turbo charged engine
- 8 forward, 4 reverse transmission plus manual clutch
- inboard mounted planetary type final drives
- fully enclosed wet disc brakes
- standard tyres 23.1-26 10 PR LS2
- wide tyres 66 x 43-25 10 PR
- steel belted 43" (110 cm) wide
- tread depth 50 mm
- lug bar angle 23°
- wide tyres exerted ground pressure 24.8 Kpa (3.6 lb/in)
- standard tyres exerted ground pressure 36.6 Kpa (5.6 lb/in)
- skidder weight - Wides 9.14 tonnes
  - Narrows 7.56 tonnes
- skidder width - Wides 3.8 m
  - Narrows 2.9 m with S4 axles
- costs - with conventional tyres 1/9/85 \$141,296
  - wide tyres including rims 1/9/85 \$8,117 each

**TRIAL PROCEDURES**

In each trial area the machine was in a true production situation. At each trial a period of both narrow and wide tyres was monitored using identical methods.

Daily records of hours, pieces extracted, distance travelled and fuel used were recorded.

Production studies were monitored over similar haul distance and terrain for comparisons. At least 100 cycles on each configuration were required for reliable standards.

All delays, including machine break downs as well as tyre damage and wear, were recorded throughout the trial periods.

Compaction and rutting tests were used to evaluate the interaction between site and machine. Originally it was proposed to perform these at each trial site, but due to several problems it was decided to allow F.R.I. set periods at Maramarua and Mangatu to completely isolate tests from production requirements, to allow an intensive, uninterrupted study. The procedure was to prepare test tracks for up and downhill travel on slopes ranging from 0-33% (17°). Tracks are needed for both narrow and wide tyres and must be cleared of trees and vegetation likely to affect compaction process.

Cone penetrometer and core sample measurements were taken before then at 1, 3, 7, 10 and 21 passes. Detail measurements occur at these number of passes. At the same time and number of passes the degree of rutting is measured at set intervals along the track (Appendix I). Also wheelslip is measured by counting the number of wheel revolutions manually, or on video if available.

Climbing ability tests :

These require a 10 m wide strip over a range of slopes usually to a maximum of 60% (30°). All trees and slash were removed to avoid unnecessary hinderance. Then machines climbed as far as possible in forward and reverse direction until obvious loss of traction occurred. The distance to this point is then measured. Several logging machines have been used against the JD540 for comparisons.

TRIAL AREAS

Kinleith (N.Z.F.P.), Tokoroa : 15.8.85 to 20.9.85 - Yellow brown pumice/ash  
Ngaumu Forest (F.S.), Wairarapa : 23.9.85 to 18.10.85 - Clay soils  
Kaingaroa Forest (F.S.), Rotorua : 21.10.85 to 8.11.85 - Pumice soils  
Matahina (N.Z.F.P.), Tokoroa : 11.11.85 to 21.11.85 - Scoria/pumice soils  
Kinleith (N.Z.F.P.), Tokoroa : 21.11.85 to 20.12.85 - Production thinning steep slopes)  
Woodhill Forest (F.S.), Auckland : 13.1.86 to 31.1.86 - Sand hills  
Maramarua Forest (F.S.), Auckland : 3.2.86 to 18.2.86 - F.R.I. research trials (compaction and rutting tests)  
Tarawera Forest (Tas. Forestry), Rotorua : 19.2.86 to 3.4.86 - Scoria soils  
Mangatu Forest (F.S.), Gisborne : 4.4.86 to 23.5.86 - Clay soils, highly erodible  
Maramarua Forest (F.S.), Auckland : 26.5.86 to 13.6.86 - Clay soils

RESULTS

Overall analysis of all recorded data is still to be processed and final reports written.

Some broad indications are :

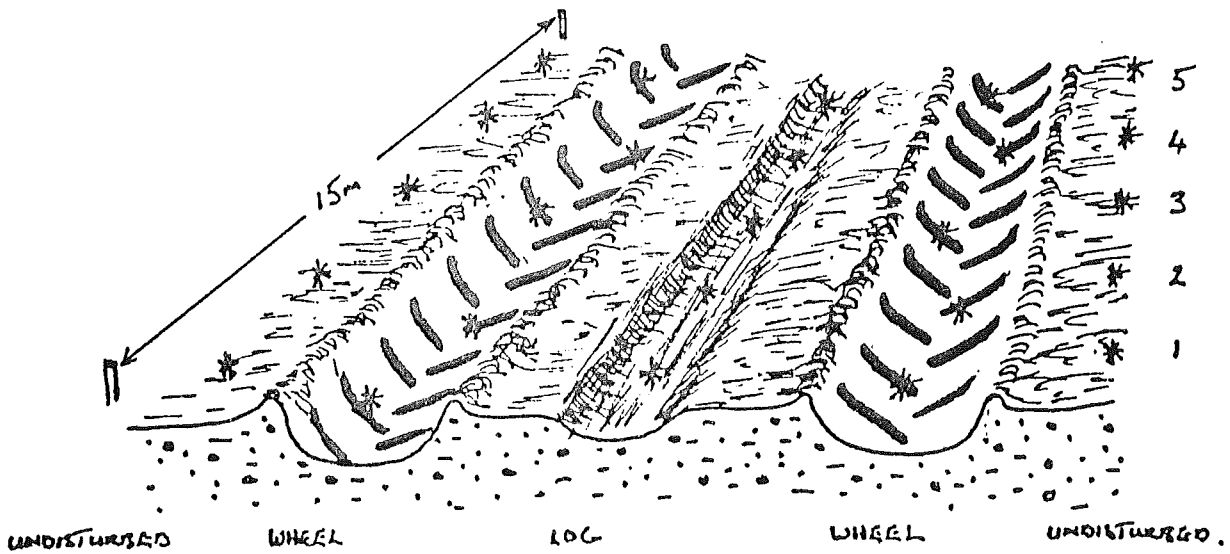
1. Very similar production levels between narrow and wide configurations in most situations.
2. Visual observations appear to favour wide tyres for better traction in both sand and scoria areas.
3. Stability of the machine is extremely good on wide tyres but also surprisingly good on narrows, perhaps due to the extra width (0.3 m) over standard machines due to position of S4 axles.
4. Winching on steep sideslopes of up to 50% (25°) with ease due to wide tyres.
5. The climbing ability on wide tyres both forward and reverse

exceeded over the narrow tyres and any other rubber tyred machine tried but not a bulldozer or F.M.C. tracked skidder.

6. Early indications from the compaction and rutting tests show less damage on wide tyres.
7. Tyre wear and damage appears to be similar to any other narrow tyred machine.
8. Due to abnormal dry weather conditions during trials at forests with clay soils, a true indication of advantages-disadvantages on clay soils has not been obtained. Results in very wet boggy clays may show similar advantages apparent from overseas research.
9. There are a huge range of wide tyres with different widths and types of construction, bar angles, treads and designs. The results using a different width or tyre could be all different again.

DIAGRAM OF SAMPLING TECHNIQUES FOR COMPACTION

- \* MARKS SAMPLE LOCATION.
- THE SAME SPOT SHOULD NOT BE SAMPLED TWICE IF AFTER ADDITIONAL PASSES HAVE BEEN MADE.



CROSS-SECTION OF MEASUREMENTS FOR WHEEL RUTTING

--- = STRAIGHTEDGE.

↓ = MEASUREMENTS THAT MUST BE TAKEN.

⋮ = MEASUREMENTS THAT COULD POSSIBLY BE WORTHWHILE TAKING.

