

# Factors affecting productivity of Vimek 404 T5 harvester in pre-commercial thinning

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# Fields of application of Kranman Bison 10000 and other small forwarders

*Scientific conference “Industrial Scale Bioeconomy and its Requirements”  
14–16 June 2017 in Lappeenranta, Finland*

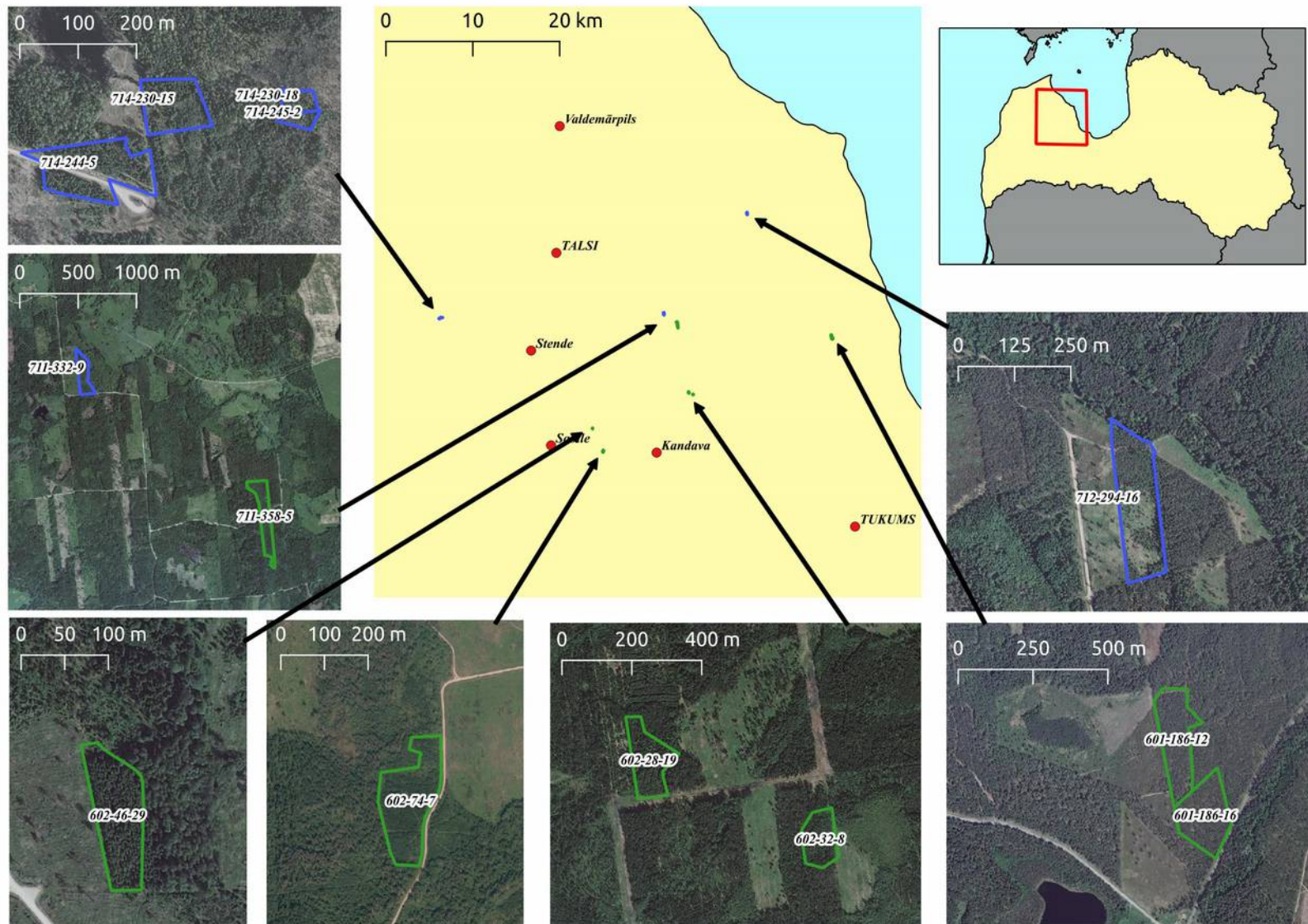
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*The study was implemented within the scope of the JSC “Latvia state forests” funded research project 'Research program on forest  
biofuel and mechanization of forest operations' (agreement No 5-5.9\_003v\_101\_16\_47)*



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# Study sites



# Typical study sites



ID	Stand type	Dominant species	Area. ha	Number of trees per ha	D <sub>1.3</sub> . cm	H. m	Growing stock. m <sup>3</sup> ha <sup>-1</sup>
601-186-12	Vacciniosa	Pine	3.4	1 917	11	12	138
601-186-16	Vacciniosa	Pine	3.3	2 925	16	16	575
602-28-19	Oxalidosa	Spruce	1.9	2 354	11	8	167
602-32-8	Myrtilloso-sphagnosa	Spruce	1.3	3 350	9	11	199
602-46-29	Hylocomiosa	Spruce	0.7	2 300	10	10	120
602-74-7	Oxalidosa	Birch	2.7	4 233	10	12	285
711-358-5	Oxalidosa	Spruce	3.5	1 104	9	12	62



# Why small harvester?



Parameters	Numerical values
Production	In production since 2011, continuously improved from model to model
Price	Basic setup 180000 €
Operating weight	4 100 kg
Engine output	36.4 rpn. min. <sup>-1</sup> or 44.7 kW
Dimensions	Length 3.35 m, width 1.84 m
Crane max. reach	4.3 m
Fuel consumption	4-4.5 L hour
Felling head	Keto Forst

# Summary of study results

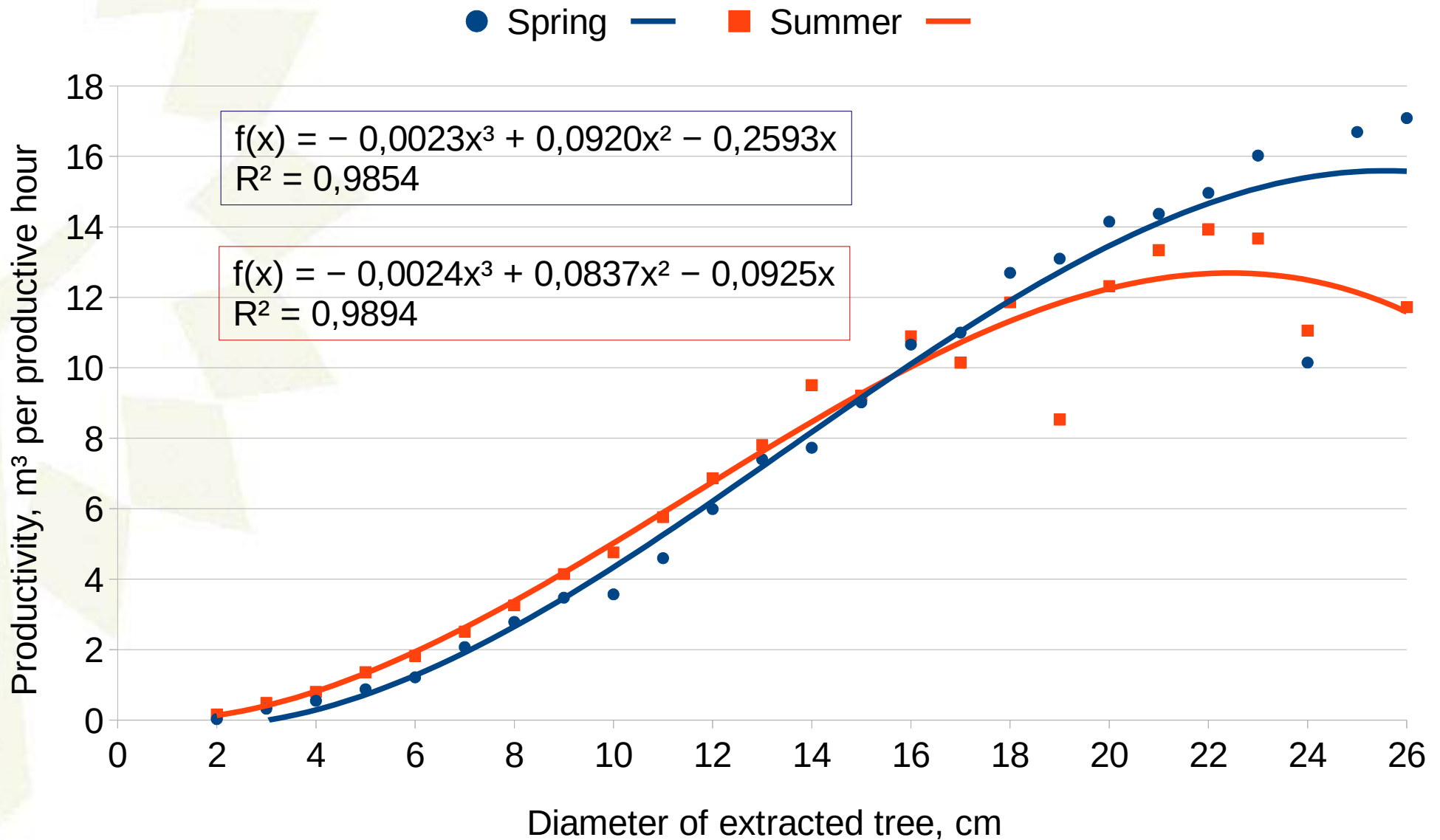


Parameter	Spring trials	Summer trials
Extracted trees	13993	8073
Extracted amount, m <sup>3</sup>	1109	350
Average tree D1.3, cm	10	9
Average stem volume, m <sup>3</sup>	0.08	0.04
Average productivity	6.5	5.1
Average productivity without driving	6.9	5.4

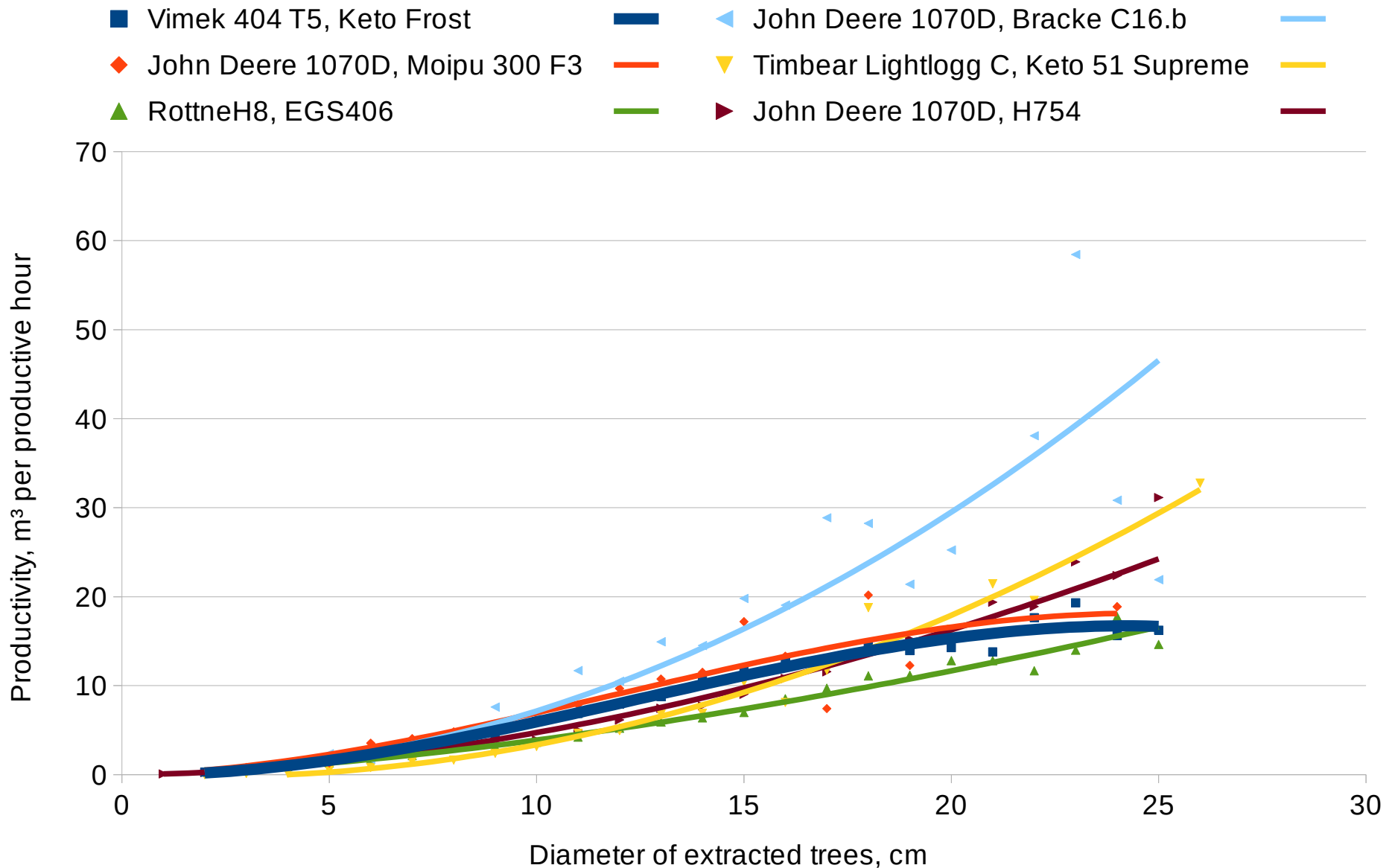




# Average productivity of harvesting depending from dimensions of trees



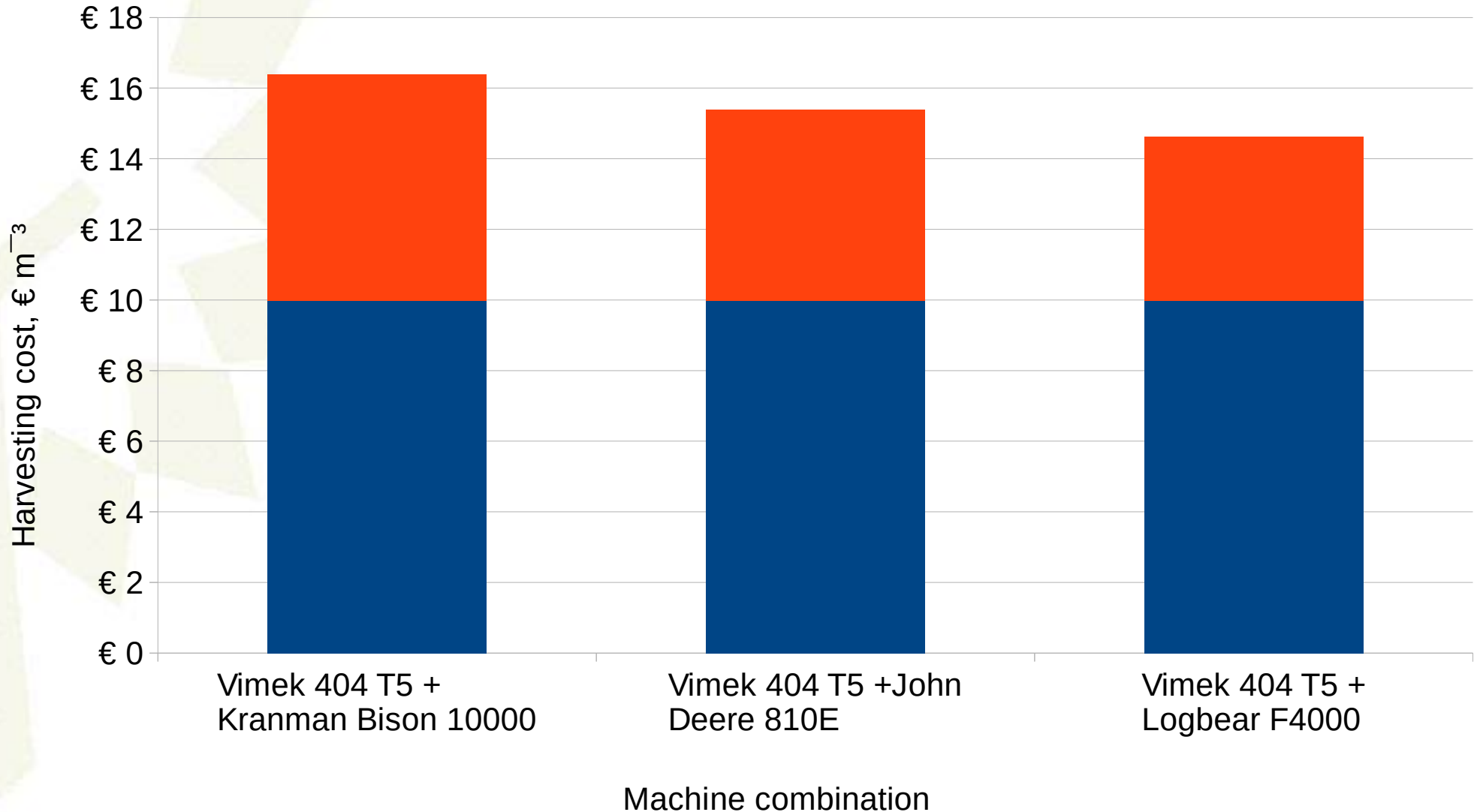
# Comparison of productivity of different harvesters and felling heads



# Impact of forwarder on prime cost of harvesting



■ Harvesting ■ Forwarding





# Conclusions & recommendations



- **In spring harvesting productivity was significantly higher**, mostly because of better visibility (*no foliage on deciduous trees*).
- **No impact of scarification** (*micro-relief*) was found; however, productivity grows faster in artificially regenerated stands with increase of tree dimensions.
- Harvesting with 2 “ghost tracks” between strip-roads significantly decreased productivity, it is **recommended to use 1 “ghost track”**.
- **Productivity on poor soils is higher** in comparison to rich soils, probably due to thicker branches and longer crown.
- Cost of Vimek 404 T5 harvester **working hour is 44 €**, it is heavily affected by utilization rate and assumptions on personnel costs.
- Vimek 404 T5 is more efficient than conventional harvesters in **pre-commercial and the 1<sup>st</sup> thinning, final felling** (if  $D_{1.3} < 20$  cm) and **cleaning operations** (*ditches, abandoned farmlands*).
- **Combination with small forwarder (Vimek 610 or Logbear F4000) is more efficient** than combination with middle class forwarder because of narrow strip-roads and high productivity values at large number of assortments.

# Field trials with Kranman Bison 10000 *700 hours of monitoring data in 2016*



# Specifications

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- Kranman Bison 10000 6WD is in production since 2015 as upgraded version on 8000 6WD model.
- Price of basic setup 40 584 €, cost of setup used in studies 60 000 €.
- Forwarder can be equipped with tracks, simple heater and even air conditioner in cabin.
- Width 1.55 m, length up to 6.10 m, weight 1.52 tonnes, load capacity 2.5 m<sup>3</sup>.
- Crane length 3.3 m (can lift up to 400 kg at full extend).
- Fuel consumption 2 L per hour (0.5 L m<sup>-3</sup>).

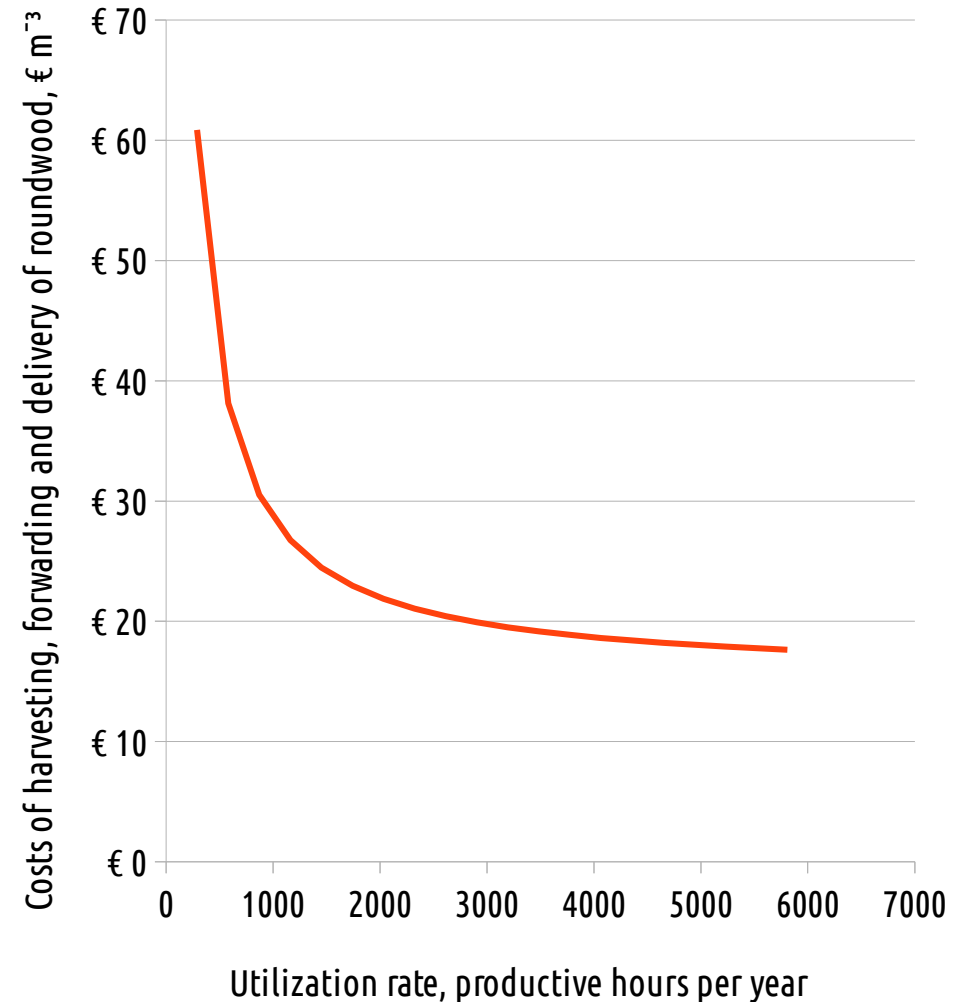
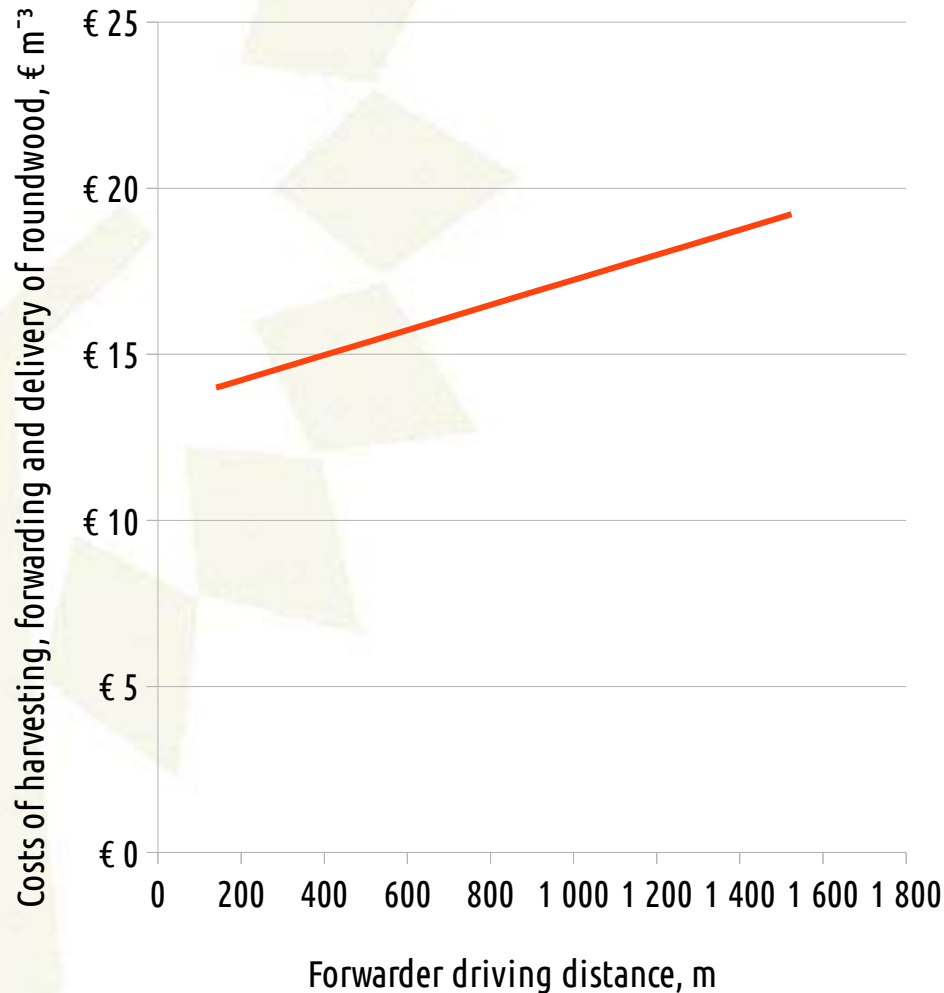
# Summary of study results



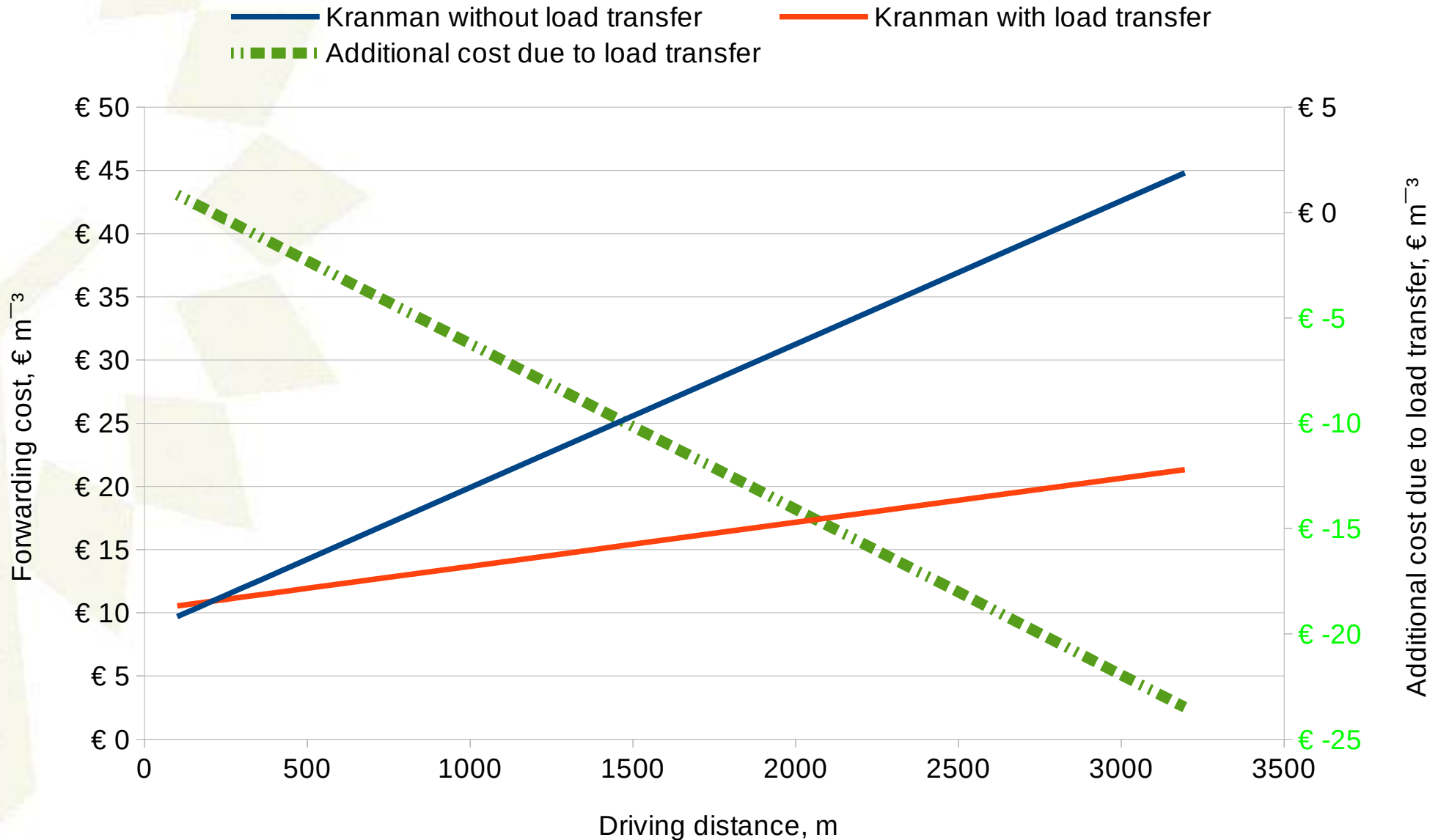
- Width of corridors – 2-2.5 m.
- Average load – 2.0 m<sup>3</sup>.
- Average driving distance – 235 m.
- Time consumption: loading in – 13.5 min., loading out – 5.4 min. per load.
- Average productivity – 3.9 m<sup>3</sup> per work hour (*15% less in extreme conditions*).
- Driving speed – 47 m min.<sup>-1</sup> (*heavily affected by presence of ruts and large stumps*).
- Forwarding cost at 1172 productive hours per year – 7.14 € m<sup>-3</sup>.
- Total harvesting & forwarding cost:
  - mechanized harvesting with Vimek 404 T5 – 16.2 € m<sup>-3</sup>;
  - harvesting with chainsaw – 18.6 € m<sup>-3</sup>.



# Impact of driving distance and utilization rate on prime cost of roundwood



# Potential impact of load transfer on forwarding cost



# Fields of application of Kranman Bison 10000 and similar forwarders



- The main advantages of Kranman Bison 10000 are small fuel consumption, small weight (*can operate on organic soils*), mobility (*can be transported with ordinary pickup*), manoeuvrability (*2.5 m wide corridor is enough*).
- The main disadvantages – small load and crane lifting capacity, limited space, vibration and noise pressure in cabin.
- Forwarder is recommended for small felling sites with small trees, including thinning, sanitary fellings and final felling.
- Optimal setup – team of 3-4 workers with chainsaws and Kranman Bison 10000 forwarder, pickup and trailer. Optimal utilization rate – at least hours annually ( $3372 \text{ m}^3$ ).
- In state forests 30 teams (*90-120 workers and 30 small forwarders*) can take over motor-manual operations in thinning.



