

EVALUATION OF THE JAPA 1400 SKIDDING GRAPPLE

Introduction

This Information Note has been produced as a guide to part of a harvesting system suitable for use in small scale woodlands. Outdoor Workshops (ODW) are a Technical Development Branch (TDB) initiative designed to offer practical advice to practical people through presentation, demonstration and user guidance. The ODW programme will involve repeating trials and introducing new systems throughout Great Britain so that a wide range of sites, systems and practitioners can be included.

Information has been gathered from equipment and method trials based at a number of locations. This information must be taken as indicative only. Variation could be expected for other operations where factors such as terrain, crop specification, product specification, operating distances or operator efficiency differ.

The System

A safe and ergonomic method of extracting timber with no manual handling required by the operator.

The unit has been designed for one man operation.

The triple jaw skidding grapple is attached by its underframe to the lower arms of a tractor's three point linkage. The hydraulic hoses of the grapple are then connected to the tractor's quick couplings on the output and return sides. A double acting hydraulic cylinder between the jaws opens and closes them.

To prevent the load from swinging the grapple can be locked mechanically from the tractor cab by use of the swing lock.

The operator reverses the tractor to the produce, stops the tractor and opens the jaws of the grapple. The open grapple is lowered onto the produce, closed, the load lifted and then the tractor moves away.

The system is a simple method of extracting timber, but only persons with correct training and experience should undertake the work.



Presentation of produce, as with all extraction systems, is very important. To reduce movement, produce should be presented in stacks which will optimise the load size. Produce need not be presented on bearers, but bearers may reduce ground damage caused by the closing of the grapple jaws. Produce needs to be stacked straight on to the tractor as it reverses in, particularly in a thinning where turning space is limited.

Equipment Supplier

The Japa 1400 skidding grapple is manufactured by Laitilan Rautarakenne, Laitila, Finland. The UK agent is:

Fuelwood Harvesting
Abbey St. Bathans
Duns
TD11 3TX
Tel: 01361 840251
Fax: 01361 840248

The cost of the grapple (1999) is c. £1 300.

A side swinging slewing cylinder is available for the grapple as an optional extra at a cost of £280.

Mechanical Specification

The technical specification of the Japa 1400 is given in Table 1.

Table 1

Technical Specification

Japa 1400 Grapple Skidder	
Maximum jaw opening (mm)	2000
Grapple area, tip to top (m ²)	0.48
Minimum gripping diameter (mm)	150
Jaw width (mm)	90/250
Gripping force, tip to top/175 bar (2500 PSI) (kg)	1000
Gripping force, fully open/175 bar (2500 PSI) (kg)	610
Frame length (mm)	1100
Cylinder diameter (mm)	60
Weight (kg)	235

Trial Performance

General: Case studies of the system were carried out on 4 different sites with varying products (Table 2 and Table 3).

The tractor used on all the sites was a Valmet 865 and the outputs relate to an extraction distance of 100 m.

Ground disturbance was noted particularly in case study 3 where the access and egress from the site was via the same track, through a standing crop. Damage included root exposure and skinning of bark on several trees of the standing crop, due in part to ground rutting and the swinging motion of the load as the swing lock was kept open.

Ground disturbance was also noted where the grapple jaws dug into the ground removing turf as the load was gripped.

Normally, stacking of produce at roadside is at right angles to the road. When stacked in this way the Japa requires a width of road equal to the length of the tractor plus the length of the produce. Where conditions allow, parallel stacking may be possible.

After 2 days work, 1 of the cotter pins on the side arm of the 3 point linkage sheared, resulting in the grapple and load dropping to the ground. Inspection of the other cotter pin showed a pinching of the metal, reducing the diameter of the pin from 6.5 mm to 5.3 mm. Further inspection of the linkage showed some play between the side arm, cotter pin and pin of the grapple. To reduce the incidence of this event, it may be useful to employ washers to take up the slack.

Table 2

Case Studies: Site and Crop Characteristics

Case Study	Operation	Vegetation	Terrain Description	Species	Age (years)
1	Thinning	A mixture of soft grasses with some ferns and nettles	Firm mineral soil Very even Level	Scots pine	40
2	Thinning	As above	As above	Scots pine	40
3	Clearfell windblow	Some bracken, briars and rhododendron	Peaty gley, soft mineral soil Rough Level	Scots pine Norway spruce Larch	45
4	Thinning	Soft grasses	Firm mineral soil Slightly even Gentle slope	Scots pine	45
5	Power line clearance	Well developed shrub and herb layer.	Firm mineral soil Uneven Gentle slope	Sitka spruce	25

Table 3

Outputs

Case Study	Product	Average Piece Size (m ³)	Average Stack Size (m ³)	Average Load Size (m ³)	Output (m ³ /shr)
1	Random lengths	0.042	0.36	0.42	5.2
2	2 m chip	0.025	0.50	0.50	7.2
3	3.8 m logs	0.127	0.17	0.44	2.9
	2 m chip	0.047	0.48	0.48	4.1
4	Poles	0.25	0.29	0.29	1.8
5	Random lengths	0.18	0.23	0.54	3.5

Comments on Output Results

Random Lengths: In study 5 the smaller stack size together with the product presentation and stack density made load accumulation more difficult than study 1 which resulted in a lower output.

2 m Chip: The difference in output of the 2 m chipwood is explained by the incidence of windblown stumps and general debris in study 3 and that the presentation of produce in study 2 was more accessible.

Poles: Mainly loads of single poles were extracted as the felling presentation and site conditions made load accumulation difficult. It is expected that in different circumstances load accumulation would give a higher output.

Further analysis of the data collected indicates that travelling time for a distance of 100 m in and out of the wood is c. 70% of the work cycle. This makes a good load size essential to achieve a good output .

It is important to recognise that good presentation, optimum load sizes and high stack densities affect movement times, which, in turn affect output.

Costing Options

There are various options for costing operating systems (Table 4) but it is possible to get combinations of these costings.

The highest costing (option A) assumes all equipment has been purchased new and all labour has been fully charged to the operation.

The intermediate costing (option B) assumes that some equipment has been purchased second hand and all labour has been charged to the operation.

The lowest costing (option C) assumes that certain elements of the cost e.g. the tractor may not be charged.

Table 4

Costing Options

Cost Option	Specification	Capital Cost (£)	Hourly Cost (£)	Labour Cost (£)	Total Hourly Cost (£)
A	Tractor (new) 65 hp, 4WD + Japa 1400 + operator	33000 + 1575	6.00 + 0.29	8.00	14.29
B	Tractor (used) 65 hp, 4WD + Japa 1400 + operator	7000+ 1575	3.50 + 0.29	8.00	13.29
C	No tractor Japa 1400 + operator	1575	0.29	8.00	8.29

Table 5

Outputs and Costs

Case Study	Output (m ³ /shr)	Cost Option (£/m ³)		
		A	B	C
1	5.2	2.75	2.56	1.59
2	7.2	1.98	1.85	1.15
3	Logs 2.9	4.93	4.58	2.86
	Chipwood 4.1	3.49	3.24	2.02
4	1.8	7.94	7.38	4.61
5	3.5	4.08	3.80	2.37

Safety and Training

All forestry operations require assessment of risk and operational training to ensure safety and efficient working.

FASTCo safety Guide 501 *Tractors in Tree Work* gives Health and Safety guidance. The manufacturer's instruction manual should also be read.

Maintenance and inspection of the skidding grapple is important.

A reduction in the length of the hydraulic hoses to all the connections is required to prevent the hoses being severed by produce.

When the load is not locked, the load is able to swing from side to side, therefore any persons within the vicinity of the unit should remain twice the product length from the tractor.

It is essential to remember that the weight and length of the load affect the tractor's handling.

Conclusions

A low capital cost system which minimises labour input as lifting is done by the grapple.

Associated TDB Publications

- Technical Note 20/96 Using Farm Tractors and Machinery in Woodlands.

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Technical Development Branch

Develops, evaluates and promotes safe and efficient equipment and methods of work, maintains output information and provides advice on forest operations.

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Please telephone for current prices