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Site Preparation with Mini-Excavators in Southern British Columbia: Observations

Introduction. Medium sized excavators (95 kW) are commonly used for site preparation in British Columbia to create mounds or scalps, pile woody debris, or remove competing vegetation. In 1991, Pope and Talbot Ltd.'s Midway Division began using "mini-excavators" (25-33 kW) for site preparation because of their lower treatment and transportation costs. Since 1992, Pope and Talbot Ltd. has used these machines on moist to wet sites with relatively low frequencies of obstacles and good trafficability, treating approximately 300 ha in the Interior Douglas-Fir (IDF), Montane Spruce (MS), Interior Cedar Hemlock (ICH) and Engelmann Spruce-Subalpine Fir (ESSF) biogeoclimatic zones in southern British Columbia. Mini-excavators have mainly been used to form mounds to provide soil warming, micro-site drainage, and vegetation control. Recently, mounding has been used as a means of reducing trampling damage from cattle. Mini-excavators have also been used to remove clumps of willow or alder, prepare scalps on upland sites, or maintain roads and install culverts. In the fall of 1995, the Forest Engineering Research Institute of Canada (FERIC) observed two Takeuchi mini-excavators, contracted from Dave's Contracting and Excavating of Christina Lake, preparing mounds near Midway, B.C.

Machine Description. Dave's Contracting and Excavating Ltd. uses two models of Takeuchi excavators for site preparation (Table 1). The Takeuchi TBO45 is the largest size of excavator that can be pulled behind a pick-up truck on a trailer (Figures 1 and 2). Larger models require a low-bed trailer. Excavators smaller than the TBO35 would likely have inadequate boom reach to operate productively (Figure 3).¹

Table 1. Takeuchi excavator specifications.

Model No.	TBO35	TBO45
Power rating (kW)	25	33
Weight (kg)	2790	4580
Width (m)	1.45	1.84
Length (m)	4.40	5.59
Boom reach (m)	4.6	5.8
Track width (cm)	30	38
Ground pressure (kg/cm ²)	.29	.27



Figure 1. Takeuchi TBO45 excavator.

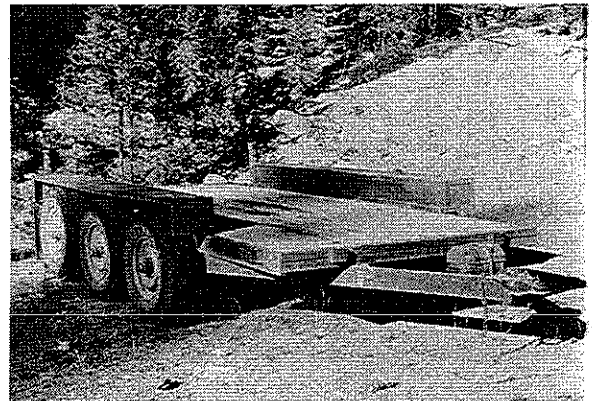


Figure 2. Trailer used to move mini-excavators behind a pick-up truck.



Figure 3. Takeuchi TBO35 excavator.

Additional guarding was required to reinforce the cab and belly of the machines, and the window glass was upgraded. A hydraulic thumb for moving debris was purchased for \$3,200, and the contractor built the 91-cm wide rake for \$1,000. On slippery ground, ice cleats may be welded to the track pads for added traction. The undercarriages are not designed for site preparation work and were replaced after approximately 3,000 hours of operation on Pope and Talbot's ground, at a cost of \$9,500¹. Undercarriage and machine life may be further reduced from working in more difficult conditions. The cost of the TBO35 and TBO45 are \$62,000 and \$80,000 respectively (fob Vancouver). Takeuchi products are distributed by Rollins Machinery of Vancouver.

Observations. FERIC observed the Takeuchi TBO35 and TBO45 mounding on a site in the dry mild Okanagan variant of the Montane Spruce (MSdm1) biogeoclimatic zone (Braumandl and Curran 1992), near Midway, B.C. Prior to harvesting in the winter of 1993-1994, the stand consisted mainly of lodgepole pine and Engelmann spruce with some western larch and Douglas-fir. The site was gently sloping (5-15%), mainly subhygric-mesic, receiving groundwater, with an LFH layer 5-6 cm thick over a loamy soil. Slash loading was low, and there was a moderate brush hazard with some patches of willow and alder.

Mounds were formed in three steps. First, the operator scraped a patch clear of litter and humus, and then lifted mineral soil onto the edge of the patch in two digging steps. Often an additional step filled the excavated pit with some litter. Usually, the operator formed three mounds from one machine location, one to each side and one behind the machine. Slash was often moved with the live thumb to clear areas for mounds and for machine travel.

Good quality mounds were observed with firm plantable spots averaging 16 cm in elevation, with gently sloping hinges of continuous mineral soil, free of debris and air pockets. Assessed plantable spots were compressed by foot, and generally positioned at half the total fresh mound height. Average mound dimensions were 117 cm wide and 77 cm long, and the excavated pits were 108 cm wide, 114 cm long and 18 cm deep. A target density of 1200 mounds/ha was achieved. The observed level of site disturbance was relatively low for a mounding operation. Operators vary the mound dimensions with changes in moisture regime and site qualities.

Machine productivity varies from 0.075 ha/h on difficult ground to 0.1 ha/h on good ground.² Productivity is slightly better with the TBO45 model because it has longer boom reach and greater power. The frequency

and size of stumps and slash, as well as stoniness and other site factors will affect machine productivity. Good operator visibility and machine manoeuvrability facilitate preservation of advance growth, increasing machine productivity on some upland sites.

Treatment costs vary from \$450-800/ha and averaged \$600/ha². Generally, Pope and Talbot's Midway Division found mounding costs with mini-excavators are \$100-200/ha lower than mounding with larger excavators (95 kW). Mini-excavators are not applicable on very rugged ground, but they could operate on many sites currently treated by the larger machines. Mini-excavators are well suited to treat small areas because of favourable costs of operations and logistics of moving.

Summary. In the fall of 1995, FERIC observed two Takeuchi mini-excavators (25-33 kW) preparing mounds near Midway, British Columbia. On this site, good quality mounds were created with firm plantable spots averaging 16 cm in elevation. Pope and Talbot Ltd. reported machine productivity varying from 0.075 ha/h on difficult ground to 0.1 ha/h on good ground. Treatment costs varied from \$450-800/ha but averaged approximately \$600/ha. Generally, costs with mini-excavators were \$100-200/ha lower than mounding with larger excavators (95 kW). Mini-excavators are not applicable on very rugged ground, but they could operate on many sites currently treated by the larger machines. Mini-excavators can be transported on a pick-up pulled trailer and are well suited to treat small areas because of favourable costs and logistics of moving.

References

Braumandl, T.F. and M.P. Curran. 1992. *A field guide for site identification and interpretation for the Nelson Forest Region*. B.C. Ministry of Forests Land Management Handbook No. 20.

Information. The information contained in this report is based on limited field observations and is only published to disseminate information to FERIC member companies. It is not intended as an endorsement or approval by FERIC of any product or service to the exclusion of others that may be suitable. More information may be obtained from:

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¹ Dave Dedard, Dave's Contracting and Excavating, Chistina Lake, B.C., personal communication, September 1995.

² George Delisle, Silviculture Technician, Pope and Talbot Ltd., Midway, B.C., personal communication, September 1995.