QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
DIVISION OF PLANT INDUSTRY BULLETIN No. 681

AN HYDRAULIC SOIL SAMPLER

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SUMMARY

To speed up the gathering of soil samples from depths of up to 1·5 m, vehicle-mounted soil samplers have been developed by the Queensland Department of Primary Industries. The sampler is mounted on the towbar of a standard utility vehicle and with slight modification could be attached to a station wagon. Sampling tubes are inserted and withdrawn hydraulically.

I. INTRODUCTION

Many problems are associated with rapid sampling of soil profiles up to 1·5 m deep unless elaborate or expensive equipment is used. Cores can be taken by hand using the sampling equipment such as that described by Veihmeyer (1929) and Wells (1959). Where larger samples are required, powered samplers of the type described by Anonymous (1960) and Wells (1959) may be used. The common method of sampling used in Queensland at present (jack hammer and extraction jack) requires considerable time for both insertion and extraction of the sampling tubes. The equipment used in this method is expensive and clumsy to use. Anonymous (1969) described a sampler mounted on a vehicle and hydraulically powered. This sampler is quick and easy to use but sampling depth is limited.

To overcome the shortcomings of the methods mentioned above, the Queensland Department of Primary Industries has constructed its own vehicle-mounted samplers. These samplers are capable of inserting and extracting 5 cm sampling tubes to a depth of 1·5 m. Several of the samplers have now been in use for periods exceeding 2 years. During this period they have proved reliable and allowed a considerable increase in sampling speed over the methods used previously.

II. DESIGN AND CONSTRUCTION

Figures 1 and 2 show a 1·5 m sampler mounted on a utility vehicle in the travelling position and the working position. The sampler is constructed of two main sections, one of these being fixed to the vehicle and acting as a guide. The other section can be extended within the guides, being in the extended position for operation and the retracted position for travelling.

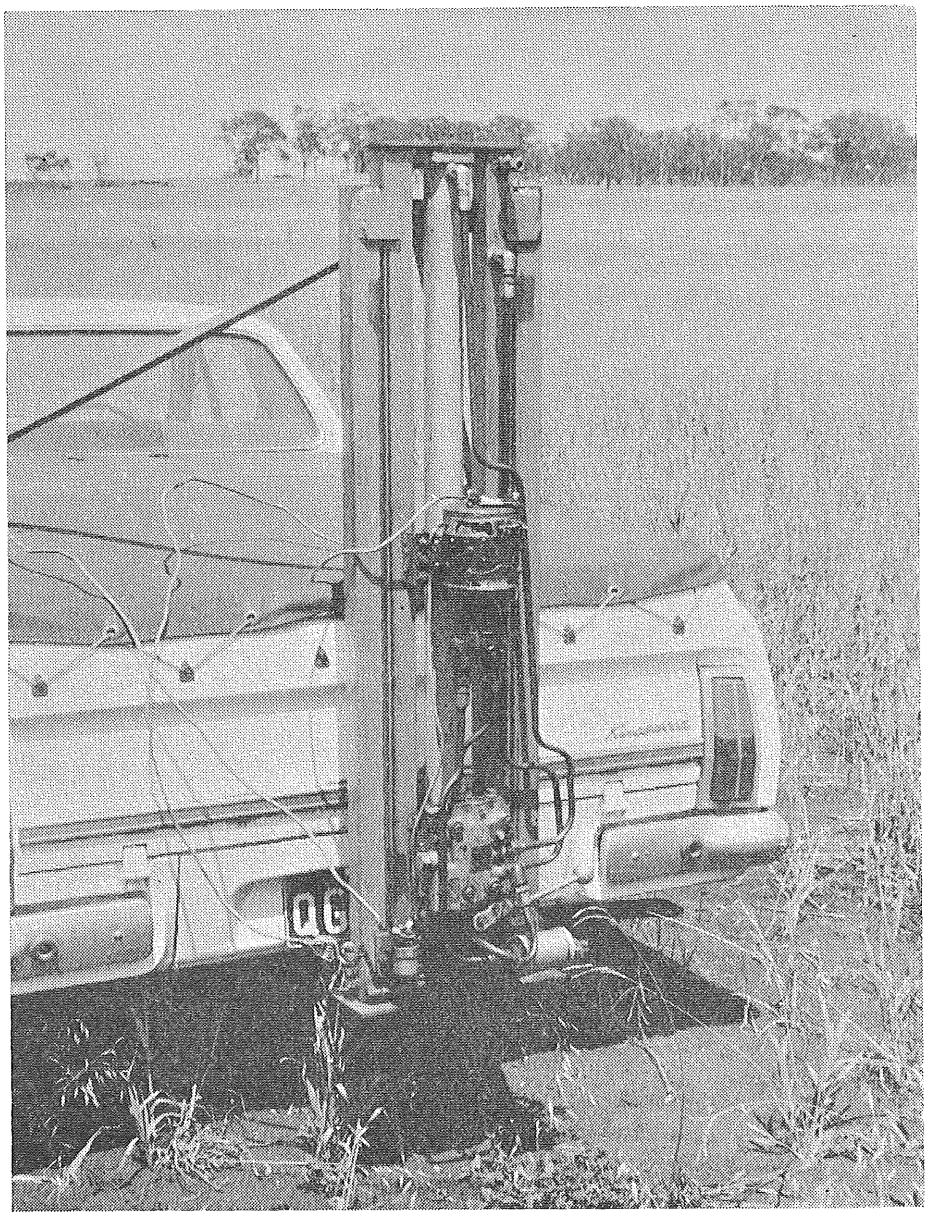

Fig. 1.—Sampler in the travelling position.

Attached to the extending frame section are the following items—double acting hydraulic cylinder (1·2 m or 1·5 m long), combined hydraulic pump and 24v electric motor, hydraulic control valve, hydraulic filter and associated pipework. One side of the moving frame acts as an oil reservoir; it is constructed from 5 cm x 5 cm square hollow section tube, and fitted with a sealable vent.

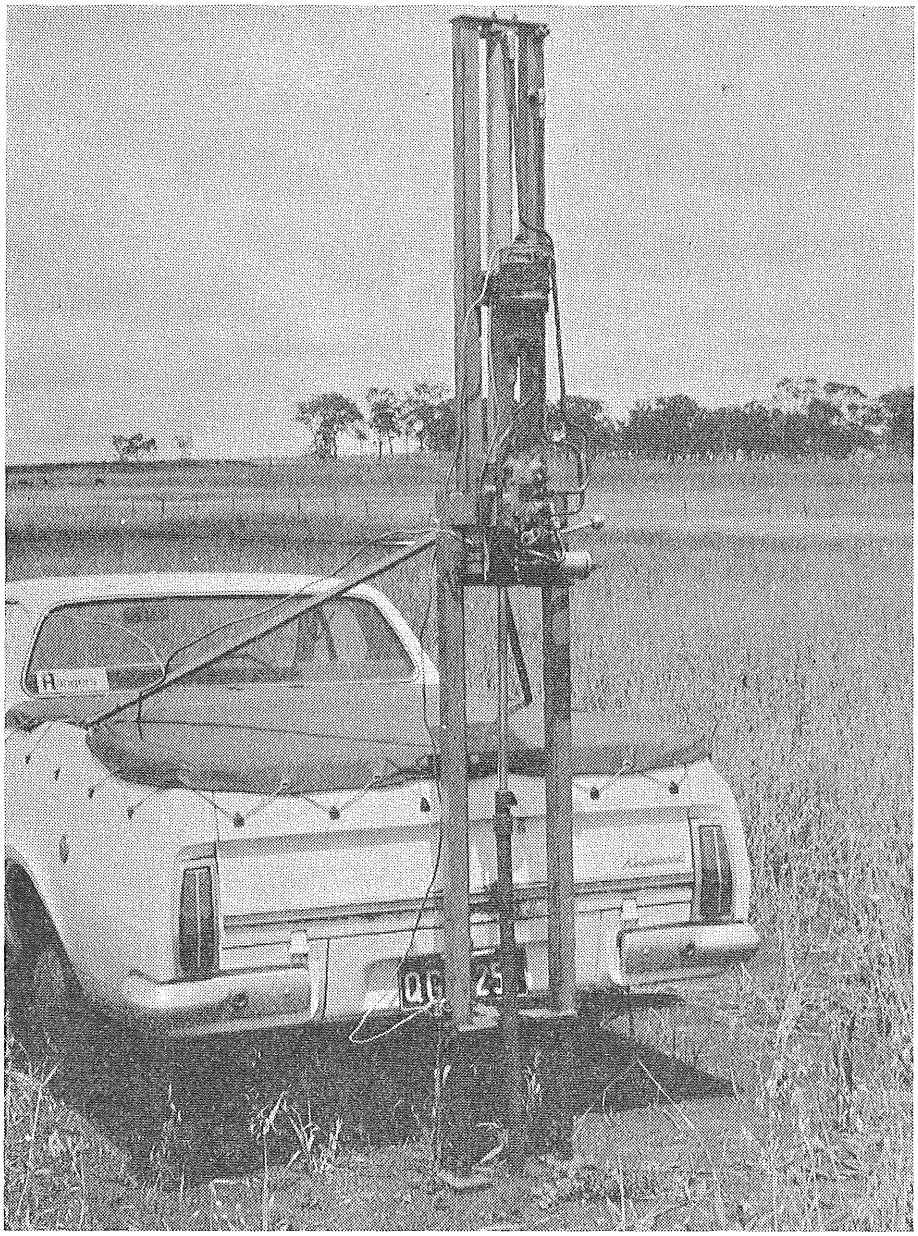

Fig. 2.—Sampler in the operating position.

The electric motor is powered by the normal vehicle battery, a heavy duty cable connecting the two items. Switching of the motor is *via* an automotive solenoid. Later models have been fitted with micro switches actuated by the control valve handle. The motor is thus switched on whenever the control valve handle is moved.

Two adjustable legs are attached to the fixed frame section and these take the vehicle weight when extracting tubes.

III. OPERATION AND PERFORMANCE

In operation, the moving frame is first extended by inserting a thrust bar underneath the hydraulic cylinder rod and operating the control valve to extend the ram (the reservoir vent being open). When the frame reaches its "stops" the control valve is released and pins are inserted to fix the frame in position. The thrust bar is removed once the pressure is released and the rod retracted.

After adjusting the support legs, a sampling tube is fitted *via* an adaptor and pins, the one on the tube being loose-fitting for ease of removal.

In general, the performance is governed by the weight of the rear of the vehicle and soil conditions. Pasture land under good moisture conditions and cultivation areas offer little resistance, but once sampling is attempted on hard, dry pasture land extra weight is needed. Care must be taken to ensure the vehicle does not move away if the rear wheels come off the ground.

The sampler is made to collect the sample by simply pushing the tube into the soil. At present a device is being constructed to enable hand rotation of the tube; this is expected to improve penetration under dry conditions.

The extraction of the sample is carried out by retracting the ram, removing the loose fitting pin (tubeadaptor) and upending the tube.

Once sampling is completed, the frame is "telescoped" by reversing the extension procedure. The reservoir vent is sealed off during travel and storage.

Sampling as carried out for land-use planning has little effect on the battery provided it is kept in good order.

Sampling for moisture or other plot trials causes a heavier drain on the battery as there is no "charge up" period between sampling. In this case the vehicle engine is left running to keep up the charge.

As the sampler motor is 24v, it is understandable that a second battery (in series for sampling and parallel for driving) would reduce battery drain and enhance motor longevity.

Total cost of components for the sampler was approximately $300 and an additional $200 could be added for the cost of labour. Further details and plans can be obtained from the Queensland Department of Primary Industries.

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(Received for publication December 31,1973)

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