A device to improve speed accuracy with manual spraying

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Spray pesticide coverage is intrinsically associated with the rate at which the applying nozzle moves: as speed decreases, application per m² will increase and vice versa. Therefore, to ensure a uniform application across the length of a target, it is necessary for a constant and accurate speed to be maintained.

Small-scale investigations into the efficacy of different application techniques (different nozzle types, flow rates, spray angles and nozzle heights) require similar application rates to allow comparisons to be made between treatments. When specialised track sprayers (Matthews, 2000) were not available, many experiments relied on walking speeds estimated by the operator.

A cheap and reliable piece of equipment has been produced to ensure a constant and accurate speed is maintained while traversing small numbers of plants throughout an experiment. A simple, durable, light weight, system was developed to provide flexibility in speed control and length of sprayed area (See Fig. 1).

Design

A simple motor system drove a coloured marker attached to a moving belt, providing an indication of speed that the operator could match with a spray nozzle. A belt, consisting of a 2mm diameter elasticated string was stretched between a 300mm diameter pulley wheel mounted at one end of a 2m long Dexion frame, with two guide wheels at the opposite end.

A marker was attached to one position on the string (Fig 1). Motive force was provided by a car windscreen-wiper motor (Lucas Industries, UK) the rotor shaft of which was fitted to the large pulley wheel. A mark/space power control system was used to set the motor speed to drive the belt at between zero and approx 1 ms^{-1}. A laptop computer power supply unit (15 Volts, 4 Amps) was used to power the motor and controller. (See Fig. 2 for technical details)

Trial

The device was used in an experiment comparing nozzles that required different walking speeds to apply a standard rate of application (0.1l/m²). Three nozzles of each type (Table 1) were mounted 50cm apart on the 1.5m boom supplied by a motorised knapsack sprayer (Shindaiwa Motors, Ltd) providing 3 bar pressure regulated with a constant flow valve (GATE, Ltd. FL, USA).

An application rate of 0.1l/ m² was intended, but the various nozzle designs created a range of flow rates, thereby requiring individual nozzles to be calibrated and a walking speed determined to ensure the standard application rate. The nozzle was moved so that it remained in the same position relative to the marker attached to the string alongside the plants.

Results

See Table 1.

Discussion

The device proved economical and speedy to build, and was effective in use.

Fig. 1. Technical drawing of the pacemeter

Images to come

Table 1. The specific walking speed required to apply 0.1l/m² across a range of nozzles.

Nozzle	Application Rate (l/m²)	Walking Speed (m/s)
XR-TT-110-03	0.105	0.27
Hypro Twin - 06	0.103	0.55
Hypro Twin - 04	0.095	0.37
Low Drift - 03	0.102	0.31

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Fig. 2. A photo of the pacemeter in use. The triangular fluorescent pink flag is used to clearly show the speed of travel.