HYDRAULIC STAKE DRIVER FOR FLOWER GROWERS[1]

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Abstract. **A low-cost hydraulic flower stake driver has been developed that will drive the stakes which support wire mesh used to hold growing chrysanthemums. Two or three men with two of these units mounted on the back of a low profile tractor can replace the much larger crew required to hand drive stakes on a typical flower farm. The direction that the stakes are driven can be adjusted so that inclined pairs of stakes can be set to hold the mesh taut. The results of time and motion studies illustrate the savings in time and labor that can be realized with the use of this machine.**

One technique used in chrysanthemum production to prevent lodging of the flowers is the use of horizontal mesh to support the long stem flowers. This wire mesh is attached at intervals to 60-inch long steel stakes. As the chrysanthemums grow, this wire supporting mesh is gradually lifted and hooked on the stakes at higher levels. The initial task of driving these stakes, which are set in pairs approximately 30 inches apart, driven 18 inches into the soil, and spaced 15 to 18 feet along the beds, is probably one of the most laborious tasks in the chrysanthemum industry, and one that has to be repeated each time a new crop is set out.

In 1973 a group of flower growers in Stuart, Florida, requested that the Agricultural Engineering Department of IFAS at the University of Florida, give some research time to the development of a simple stake driving machine that would reduce the amount of physical labor required in the setting of the stakes. Some growers had investigated the commonly available fence post driving machines, but found that these were too powerful and too large to be operated under the shade cloth and electric light wires in the flower houses. At this time, the usual method of driving the metal stakes is to use a cylindrical driver made by welding a cap on a piece of 2½-inch steel pipe. Three to five blows with these twelve pound drivers are usually required to drive stakes to the desired depth in the sandy soil of the Stuart area.

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Design and Fabrication

Observations of a conventional stake driving operation led to the conclusion that a force of three hundred to five hundred pounds would be sufficient to drive the stakes into the soil to a depth of approximately 18 inches. It was decided to investigate the use of hydraulic power from a tractor to drive the stakes by means of a direct force linkage or by impact from a falling weight. Since the total energy required to set the stakes in the ground was well within the work capability of a standard farm implement remote control cylinder, it was decided that a direct force driver would be possible. Two advantages of the direct force driver over an impact machine are simplicity and safety. Because mechanisms used in direct force drivers are not as complex as those on most impact machines, they tend to be more trouble free. Also, most direct driving mechanisms are under the complete control of the operator and the driving ram can be stopped at any moment. This mechanism is in contrast to the free falling hammer used in any impact driver which cannot be easily stopped until it completes its stroke. The mechanism selected for this stake driver is a four-bar kinematic linkage with one sliding and three pivoted connections. A diagram of this mechanism, along with the hydraulic cylinder which provides motion, is shown in Fig. 1. Since this machine might be used to set stakes deeper than 18 inches, it was decided to design a driver having an effective stroke of 32 inches and actuated with an ASAE (1) standard 8 inch stroke double acting hydraulic cylinder. With 1000 PSI hydraulic pressure in a 3½ inch bore cylinder, the driver has a push of 1832 pounds at the beginning and reaches 2712 pounds at the end of the driving stroke. The design utilizes steel channels and square steel tubes for the main frame and ram components, and the ram is guided and rolls on 4 ball bearing rollers. When one driver unit was fabricated and mounted on a tractor for preliminary evaluation, it was found that the unit would drive steel fence posts into a clay soil to a depth of two feet. A second stake driver was fabricated so that two units (Fig. 2) could be mounted on a tractor for driving pairs of stakes. An attachment frame for the tractor was designed which allows for adjustment of the spacing between the stakes to allow for variations in the wire mesh size. Provision was made to tilt the drivers on the attachment frame so that the pairs of stakes can be

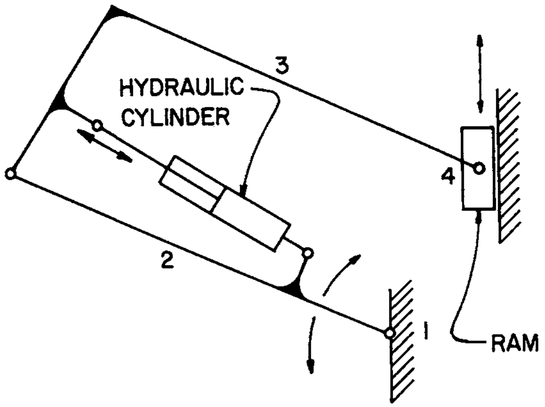

Fig. 1. Stake Driver Mechanism (Four-bar linkage).

set with the tops spread apart to assist in holding the wire. Two four-way hydraulic control valves are mounted on a standard between the drivers within convenient reach of the driver operators. Racks are provided for carrying up to about 20 stakes on each side of the machine and this supply is sufficient for a trip up one bed and a return trip in most ffower houses.

A three man crew is required to operate the stake driving unit: one tractor operator, and two stake driver operators. The procedure for driving a pair of stakes is as follows:

1. The tractor operator positions the tractor by straddling the bed and registering the driver units with openings in the wire mesh.
2. Each stake driver operator places a stake under the ram, properly aimed at a mesh opening.
3. Each driver is actuated with the individual hydraulic control and the stake is driven into the ground.
4. The driver rams are retracted.
5. The tractor operator moves the unit to the next position upon signal from one of the driver operators.

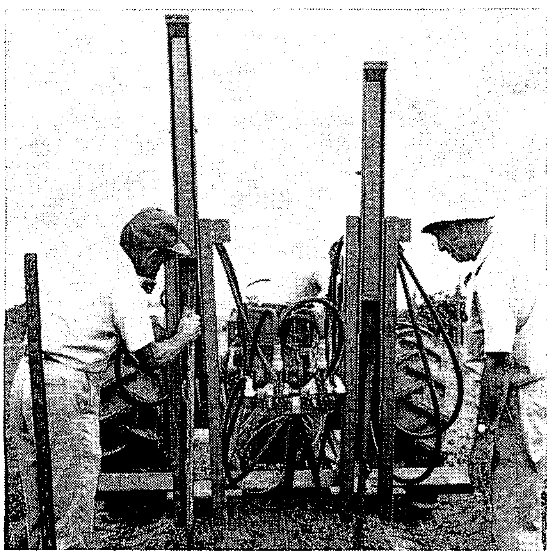

Fig. 2. Hydraulic Driver Setting Stakes.

Machine Performance

Two hydraulic stake drivers mounted on the rear of an IH 544 tractor were used to drive stakes in flower beds ranging from 120 to 135 feet in length. With an inexperienced crew and with stakes within reach of the driver operators, 14 stakes were positioned and driven in 2.37 min. This is a labor input requirement of 0.54 man-min/stake when the time required to load the stakes into the carrying racks on the machine is included. Once it was positioned, the actual time required by the machine to drive a stake was 3 to 4 seconds, depending on the tractor engine speed. As a comparison, time studies showed that the labor requirement for distributing, positioning, and driving stakes manually ranges from 0.41 to 0.67 man-min/stake when a six man crew is used.

Discussion

The use of a hydraulic stake driving machine appears to be practical for chrysanthemum growers. Some advatages of this hydraulic stake driver are as follows:

1. The machine eliminates the strenuous work of manually driving stakes.
2. The machine makes it possible to set the stakes at uniform inclination and height.
3. The tractor carries the stakes and this eliminates distribution by hand.
4. The machine is safe to operate since the ram is controlled hydraulically, both up and down.
5. The machine is simple to operate.
6. The machine is readily mounted and dismounted once the mounting brackets are adjusted to the tractor.

Some disadvantages of a machine of this type are that it ties up a tractor and costs more than manual driving equipment. The estimated cost of this machine is probably around $1,200 to $1,500, including two driver units, mounting brackets, and hydraulic cylinders. The hydraulic cylinders can be used on other agricultural machinery. Since the fabrication of this machine is very simple, some growers might build their own drivers when plans become available through the Florida Cooperative Extension Service.

Literature Cited

1. ASAE Cooperative Standards, 1974, "Application of hydraulic remote control cylinders to agricultural tractors and trailing-type agricultural implements" (ASAE S201.4) *Agricultural Engineering Yearbook*, 21st Edition, 199-201.

EFFECTS OF SHADE, MIST AND ANTITRANSPIRANT ON ROOTING AND NUTRIENT LEACHING OF LIGUSTRUM JAPONICUM AND CHRYSANTHEMUM MORIFOLIUM CUTTINGS[1]

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Abstract. **Two rooting experiments using Ligustrum japonicum and Chrysanthemum morifolium cv. 'Fred Shoesmith' were conducted to determine effects of mist, shade, and an experimental antitranspirant (Dover 33-30) on rooting and nutrient leaching. Antitranspirant levels were generally ineffective in increasing percent rooting, root quality or preventing nutrient leaching. Mist was more effective than hand watering, and shade more effective than full sun in increasing rooting. Cuttings under mist generally had lower percent elemental content than those under hand watering, but had as much or more total elemental content per cutting.**

The nursery industry has become dependent on misting systems for propagation of woody ornamental cuttings. Mist systems are expensive to install and maintain, and may leach large amounts of minerals from the foliage, resulting in growth lag when rooted cuttings are potted. Much labor and handling is required in transplanting operations and cuttings are often left under mist too long, resulting in root bound conditions or disease problems.

Efficient, effective and less expensive methods of rooting cuttings might be obtained with the use of antitranspirants to coat cuttings with a thin film of material to permit gas exchange but prevent transpiration.

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Previous research with antitranspirants has involved their use in transplanting and results have been variable. A primary problem encountered by Gale and Poljakoff-Mayber (2) in work with plastic film antitranspirants is that photosynthesis is reduced as much or more than transpiration, probably because permeability of these films is greater for water than CO_2. Gale and Hagan (1) felt there is the need to develop antitransparent materials which permit more gas exchange and higher water retention.

Nutrient leaching from plants under mist has been reported previously, (3) (4) (5). Tukey *et al.* (6) reported more leaching from older tissues than from young vigorously growing tissues and Good and Tukey (3) stated that reporting nutrient loss in terms of percent dry weight is valid only if no growth occurs during rooting and, with growth, data should be reported as total nutrient content per cutting.

Experiments were designed to test effectiveness of an antitranspirant compound on rooting and prevention of nutrient leaching on two species of plants at two levels each of light and watering regimes.

Materials and Methods

Two rooting experiments were conducted with cuttings in flats containing Canadian peat: perlite 1:1 v/v placed on outside benches. A mist system which turned on at 6 a.m. and off at 8 p.m. EDT had a cycle of 4 seconds on per minute and bathed half the experiment.

Experiment 1 was initiated July 13 and terminated September 6, 1974 utilizing *Ligustrum japonicum* Thunb. as the test plant and utilizing an experimental antitranspirant-antidessicant com-