from the main well) per season, the production of most vegetable crops would become unprofitable. In this situation, though, the use of the water conveyance and recovery system provides a viable irrigation alternative for vegetable crop production. Therefore, producers should thoroughly evaluate their individual situation and circumstances before committing themselves to a high capital requirement water recovery system.

Producers that have existing water holding facilities available or have an opportunity to significantly reduce the excavation costs of constructing a lake will be among the first to profitably utilize a water recovery system when conditions permit. For most, the profitable investment in a water recovery system will likely only occur in the event that water becomes a limited resource and the total water recovered approaches the total water conveyed.

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AN INTERMITTENT PERISTALTIC FLUID DRILL FOR VEGETABLES[1]

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Abstract. **An intermittent peristaltic fluid pump has been developed to meter gel with suspended seeds for fluid planting. This apparatus is an improvement over previously developed equipment because the gel and seeds are not recirculated thus reducing seed damage. Since the intermittent pump has a simple mechanical drive it can be powered from a ground wheel and no adjustments are necessary for variations in speed.**

The concept of planting seeds suspended in a fluid gel medium was originated by J. G. Elliott, of the Weed Research Organization, Begbroke, Oxfordshire, England nearly 20 years ago for the replanting of pasture and rangeland with grass seeds in established sod (3). This plant establishment technique has been further developed by the National Vegetable Research Station in Wellesbourne, Warwickshire, England for vegetable and flower crops and is gaining in use and popularity throughout the world (2). This planting technique makes possible first of all the germination of seeds in an ideal environment of temperature and moisture conditions before the seeds are placed in the soil. Sprouted seeds can be planted with minimum damage because the gel medium protects and lubricates them as they are metered through the planting machine and conveyed to the seed bed. In the soil the gel keeps the seed moist and can reduce irrigation requirements. When sprouted seeds are planted more uniform seedling emergence results which in turn leads to more uniform maturity of the crop. Additives such as pesticides, fungicides, growth regulators and small amounts of fertilizers can be included in the gel for improved plant emergence and growth.

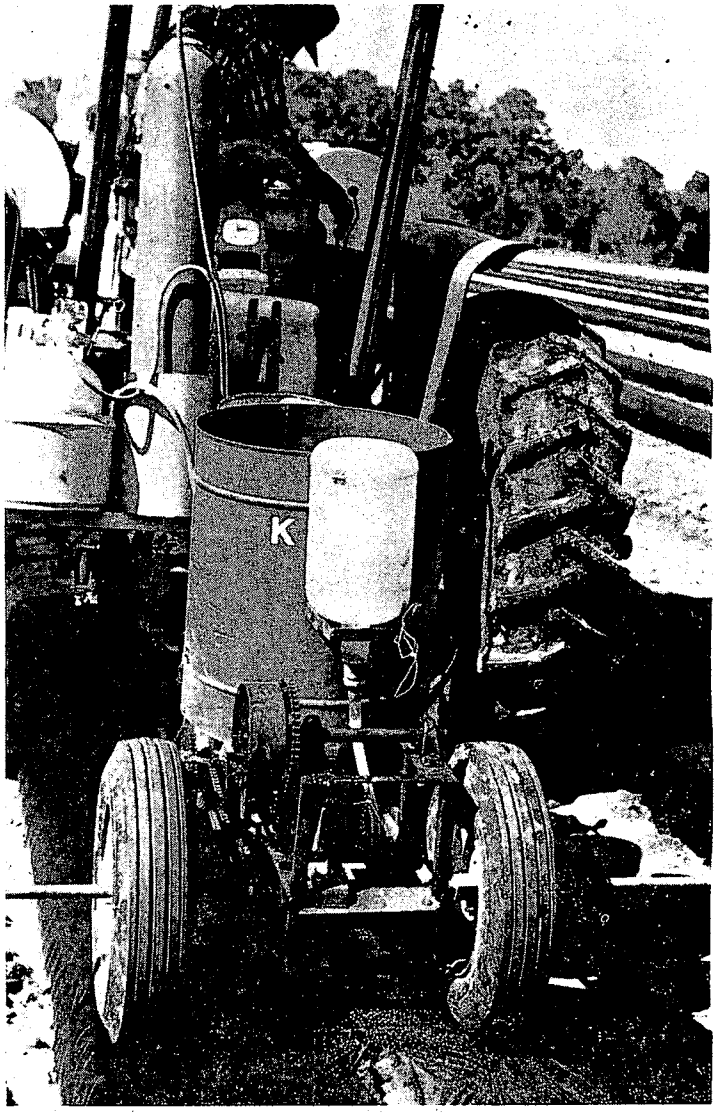

Fig. 1. Fluid planter unit.

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Previous Planter Developments

A fluid planter utilizing a continuous action peristaltic pump supplying a recirculation system and a solenoid valve to control the gel discharge was designed and assembled by Union Carbide Company and tested in cooperation with IFAS in 1977 (1). This unit was tested with sprouted tomato seed on the rock soils at AREC, Homestead and satisfactory plant emergence resulted from late summer plantings. This fluid metering system functioned but difficulties were experienced with seeds clogging the pressure relief valve and the solenoid valve and many of the seeds were damaged during recirculation throughout the system.

A planter utilizing an electrical solenoid driven pump manufactured by Kevin G. Skipper Farm Supply Ltd., of Merlin, Ontario, Canada was modified to give intermittent action for gel seeding through plastic mulch but the operation of this unit was not entirely satisfactory because of the high electrical power requirements for this unit.

Intermittent Peristaltic Pump Planter

A fluid drill utilizing a two roller peristaltic pump and a ratchet drive to give intermittent action was assembled and first tested with the sprouted tomato and watermelon seeds early in 1979. The metering mechanism was incorporated into a planter unit with a combination mulch burner-dibbler and an anti-crustant metering device (Fig. 1). This unit can burn regularly spaced holes in plastic mulch covered beds, make planting depressions in the soil, deposit approximately 10cc's (0.61 in^3) of a gel-seed mixture and apply an anti-crustant medium over the seed (Fig. 2). The operation of this planter was satisfactory with a seed concentration averaging 3 sprouted tomato seeds per glob of gel. Because only a two roller pump was used a speed increase drive was required between the ratchet and the pump. This arrangement is not a good mechanical design so an improved drive has been developed.

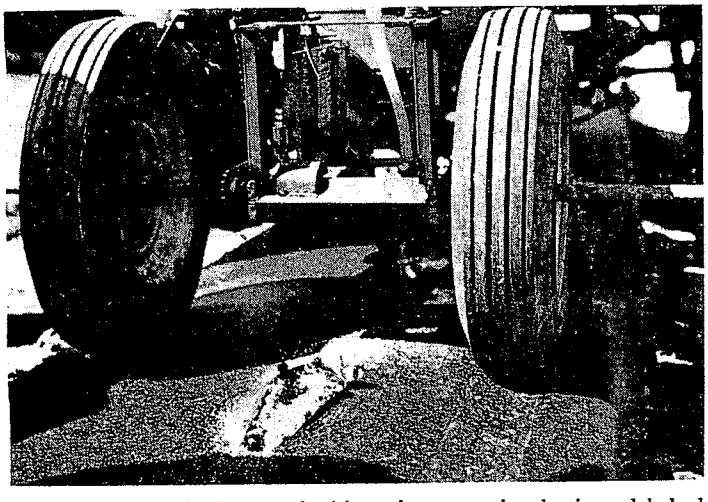

Fig. 2. Seed and gel covered with anti-crustant in plastic mulch bed.

A twelve roller peristaltic pump with a direct ratchet drive has been developed and evaluated for a fluid planter (Fig. 3). This metering concept is much simplier than the two systems utilizing solenoid valves and electric pumps since power can be taken from a ground wheel and no electrical power is required. The gel and sprouted seed are subjected to the pump metering device only once because none of the mixture is recirculated; consequently, seed damage is greatly reduced. No adjustments have to be made in the metering device for changes of planting speed. The roller wheel was designed to operate horizontally to reduce the hydraulic head on the gel between the tank and the discharge nozzle in order to reduce leakage through the pump metering mechanism. With a 1.6 cm (5/8 in) I. D. tubing the peristaltic metering device dispenses approximately 4.4 cc (0.27 in^3) globs of gel. The size of the globs can be changed by changing the tubing size. Initial tests of the metering device showed the uniformity of the globs was within $\pm$ 20% of the average size when a fairly stiff gel was used. Presently no standard method of measuring gel viscosity has been established.

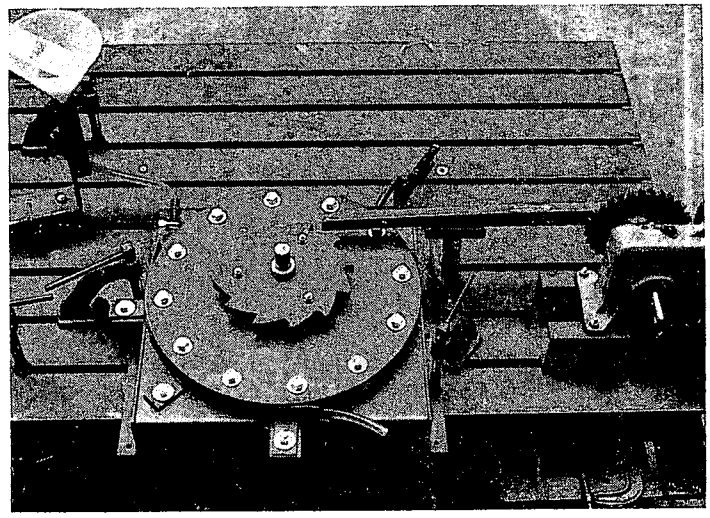

Fig. 3. Horizontal peristaltic gel metering mechanism.

This horizontal peristaltic pump fluid metering device will be incorporated into a planter unit and evaluations made in the field this coming season.

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