

FERTILIZER APPLICATION EQUIPMENT FOR BAREROOT AND CONTAINER NURSERIES

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Key Words

Broadcast spreader, seed drill, fertigation, fertilizer injection

Fertilizer application equipment can apply chemicals in dry or liquid form or as manure. The appropriate equipment will place the material at the desired rate in the desired location. In bareroot nurseries, fertilizer is usually applied dry in granulated pellets or coated form. Where in plentiful supply, animal manure may be used, both for nutrients and organic matter. In container production, nutrients may be applied in granular slow-release form or, more commonly, injected into the irrigation water supply.

APPLICATION EQUIPMENT FOR DRY CHEMICALS

Drop-Type Fertilizer Distributor

Tractor mounted and trailer machines are available. Hand-pushed distributors are used for small beds. The hopper has a V-bottom with agitator and adjustable gates that control the rate of flow through the holes. Hopper widths are available from 2 to 12 feet and spread the fertilizer over the bed.

Broadcast Spreader

This is also called a spin or cyclone spreader. The fertilizer hopper can be trailer or tractor mounted. Hand-operated machines are also available. Fertilizer is distributed by 1 or 2 spinning disks located below the hopper and powered by the tractor or a set of drive wheels. Application rate is controlled by a slide gate. Ground coverage is greater than with the drop-type distributor, but uniformity is not as good.

Seed Drills

This equipment can be fitted with fertilizer hoppers that apply chemicals at the same time seeding is done. Metering devices include the star wheel, feed roll, wire worm, or auger. Drop tubes direct the fertilizer into the same furrow as the seed. Liquid fertilizer can also be injected into the soil.

Individual Pot Applicators

This drop-type applicator feeds small quantities into individual containers. The hopper holds a quantity of fertilizer that can be conveniently carried. A measuring device meters the chemical and drops it into the pot. Several thousand pots can be fed per hour.

INCORPORATION OF FERTILIZER INTO GROWING MEDIA

For batch mixing, granular fertilizer can be dumped into the mixer along with other components before mixing. For continuous mixing, a fertilizer dispenser meters the chemical onto the conveyor belt before components reach the mixing unit.

SELECTING AN APPLICATOR

The size of the nursery influences applicator selection. A large machine may be too expensive to own and difficult to maneuver in small areas. A small machine may require frequent stops for refilling.

Drop or broadcast spreaders take less power than drills. Stony soil is less of a problem.

Placement of the fertilizer can affect the growth of the crop. Fertilizer placed on top of the soil may take time before it reaches the root system.

Fertilizer applicators are heavy when full.

Flotation tires may be a good investment especially if the application is made when the soil is wet.

If you already have a tractor, you may want to size the machine to fit it. Some manufacturers list horsepower requirements for their machines.

Because fertilizers are corrosive, many modern applicators have stainless steel or plastic parts. Machines should be cleaned after each use.

Ease of calibration is important to get accurate application and to avoid the cost of overfertilization. It should be done with each change of fertilizer material. Follow the instruction manual to make the correct adjustments. The rate of fertilization is found by collecting the material over a known area.

MANURE SPREADING EQUIPMENT

Animal manure can add nutrients and organic matter to the soil. It can be handled as a solid, semisolid, or liquid. The amount of water and bedding influence its form. Horse, sheep and poultry manure are usually solid. Depending on the type of housing, dairy and swine manure may be any of the 3 forms.

Selection of a spreader should be based on the type of manure available and the size of the nursery. The 3 most common types are box-type, flail, and tank spreaders.

Box-type Manure Spreader

The size of the spreader is usually designated by what volume in cubic feet that the box will hold. The power needed to drive the apron chain comes from either the tractor PTO or the spreader wheels. The rate of feed and the speed of the beaters is usually variable. This type of spreader can also be used for the application of compost or mulch materials.

Flail Spreader

This spreader consists of a horizontal liquid-tight tank mounted on wheels. It is designed to handle solid or semisolid manure. Flail chains on a powered horizontal shaft throw the manure out by centrifugal force. A uniform spreading width of up to 20 feet can be achieved.

Tank Spreader

Where liquid manure (less than 10% solids) is available, it is usually loaded with a pump and spread with a tank spreader. The spreader can be either trailer mounted and pulled with a tractor or truck mounted. The liquid flows to the rear of the tank where it flows onto a spinner for spreading. Tanks with capacities of 1,000 to 5,000 gallons are available.

FERTIGATION

Fertigation is the controlled feeding of nutrients to plants through the irrigation system.

Application of fertilizer through the water system has several advantages:

1. Easy adjustment of nutrients, depending on crop needs.
2. Nutrients become available to the plants quicker.
3. More accurate placement of fertilizer.
4. Less fertilizer needed.
5. Reduced labor to apply fertilizer.

Irrigation can be done with many systems; 4 are described here.

Overhead

Lateral supply lines feed sprinklers that produce a circular pattern for outdoor plants in the nursery or for seedlings growing in a greenhouse. To be effective, a pattern of at least 60% overlap is needed to get uniform coverage.

Boom Irrigator

Equipment for applying irrigation water with a boom that travels over the growing area is available for both outdoor and greenhouse production. This system is the best method for watering plug and cell trays, as very uniform application can be made. Both hand operated and computer-controlled booms are available.

Drip Irrigation

Improvements in drippers have made this system viable for beds and larger containers, which results in considerable savings in water and nutrients. Clean water is required. Pressure compensating drippers are required for sloping beds to get uniform distribution. High-output drippers are now available for quicker application of water and less clogging.

Capillary Systems

Mats, trays, benches, and flooded floors are systems where the nutrient solution is absorbed by the growing media from underneath the container. These systems work best with small containers and plug trays.

FERTIGATION EQUIPMENT

Venturi Suction Device

The simplest low cost devices use the Venturi principle to create a pressure differential between the container holding the fertilizer solution and the water line. As water passes through the restricted area of the injector, the velocity is increased, creating a vacuum. A small tube connected at this point allows the fertilizer concentrate solution to be siphoned into the water stream and mixed before reaching the plants. The fixed-dilution ratio will vary somewhat with water pressure differences and hose length.

Bladder Tank

These units use a pressurized tank attached to the irrigation line in two places. A control valve achieves a pressure differential between the inlet and outlet. Inside the tank, a plastic bag (the bladder) holds the fertilizer solution. Water from the supply line surrounds the bag forcing the solution through a metering valve into the water supply. The bladder improves the uniformity of discharge. The rate of fertilizer injection can be regulated to some degree by varying the pressure. There are no moving parts and the bag can be replaced easily.

Water Motor Controlled Injector

Water motor-driven proportioning injectors use water flow to operate a piston or diaphragm to inject or force fertilizer into the water stream by positive displacement. As water flows through the injector, the water causes a cam to turn and push a piston back and forth. This equipment gives consistent feeding ratios at specific flow rates over a wide range of pressures. Water motor injectors usually decrease line pressure more than water meter styles.

Water Meter Controlled Injector

These injectors use a water meter mechanism to determine flow rate and a water or electric powered diaphragm pump to inject the fertilizer.

They can be purchased with several heads attached to the same motor so that more than 1 nutrient can be fed at the same time.

SELECTING AN INJECTOR

All types of injectors can be successfully incorporated into a greenhouse or outdoor irrigation system. The following factors should be considered when making a selection.

The injector must be compatible with the water flow rate in gallons per minute. Most injectors have a range of flow over which they will operate. Select one that will allow for some expansion should a different irrigation system be installed, but don't oversize it, as larger injectors may not work when 1 hose is turned on.

Except for the Venturi type, all injectors have variable dilution ratios. This is desirable, as available concentrations or the size of the mixing tank may require different ratios. Check on the ease of changing the ratio.

Injectors with an integral mixing tank are available in several sizes. A separate concentrate supply is needed for most injectors. A 5-gallon pail is adequate for 1 hoop house. Larger plastic or concrete tanks can also be used. Select a tank large enough to feed a single greenhouse or several zones to reduce frequency of refilling. In larger ranges, nutrient concentrate may be distributed from a central tank throughout the range in PVC pipe. Agitation within the tank is important to maintain a uniform solution.

Fixed units are used in small operations or where all irrigation water is piped to the greenhouses. Portable units can be moved from one area to another.

Multiple injector units are required where more than 1 chemical is applied at the same time. They are also used where individual nutrient levels are monitored by a computer.

Check the specifications for the amount of pressure loss caused by the injector. Some units lose as much as 15 psi. For some water systems, this may limit the amount of hoses or number of zones that can be operated at one time. Also, be sure that piping is large enough to keep pressure loss to a minimum.

For large operations, an injector that can be integrated into the computer system is desirable.

Sensors, pumps, and water meter should be compatible with the software.

Check to see if the injector is compatible with the chemicals that you will be applying. Water should also be clean to avoid wear. Most manufacturers recommend that a 200 mesh filter be inserted before the injector.

Safety devices should be installed in the system to prevent backflow into the water source. A backflow preventer is required on all systems connected to potable water. A check valve should be installed in the chemical injection supply line. An interlock should be installed to prevent an

electrical injector pump from operating if the water flow stops. Repair parts and dependable service should be available locally.

Injector operation must be checked frequently and calibrated to ensure proper operation and application rate. Follow the manufacturer's recommendations for calibration.

Additional information is covered in the booklet, "Fertilizer and Manure Application Equipment"—NRAES-57, available for \$6.00 from the NRME Dept., UConn, Storrs, CT 06269-4087. Make check payable to UConn.