FERTILIZERS do the most good when the right amount of the right kind is applied in exactly the right place. It must be applied at a constant rate and evenly, so that all plants get equal amounts of food. The right place is a definite position with respect to the seed or plant. To do this, many new machines have been developed for one crop or condition after another in recent years. More than 100 American manufacturers now make several hundred items of equipment for distributing fertilizer. Improvements and changes in details of design are frequent as new needs and ideas develop, plant-food materials are produced in different forms, farm practices change, and research men and engineers are called on to find answers to new problems.

Placing the fertilizer in a band at one side or both sides of the row is an effective and reliable method that can be used under a wide range of conditions for a large number of crops. The best location of the band in most cases is 2 to 3 inches to the side of the seed or transplant, and 3 to 5 inches below the surface of the soil. The desirable position of the fertilizer at the side of the row differs somewhat for the various crops, amounts of fertilizer, and other conditions.

Even in the case of unusually heavy applications, where major portions of the fertilizer can be deeply applied in several different ways before planting, it is well to put a reasonable amount of the plant food at the side of the row to stimulate the growth of the very young seedling. A possible exception is in highly specialized crops grown in closely spaced rows, when it may be best to incorporate thoroughly adequate amounts of fertilizer all over the tilled area.

The first machines for side placement of the fertilizer, produced by a few manufacturers 10 years ago, consisted mainly of certain types of corn,
cotton, and potato planters, and tractor attachments for cotton. The runner-frame type of corn planter was equipped to place the fertilizer along each side of the row, slightly above seed level, either in continuous bands or short bands at each hill. The other machines placed the fertilizer in a continuous band at one side or both sides of the row. The newer improved equipment for the purpose includes planting and fertilizer distributing attachments for general-purpose and garden tractors, various types of cotton planters, machines solely for applying fertilizer, transplanters, vegetable crop drills, and beet and bean drills.

Equipment regularly mounted on general-purpose tractors of various sizes is available for placing the fertilizer in a band at the side of the row. Two arrangements are employed. One provides for a single placement of the fertilizer by having the seed and fertilizer furrow openers mounted closely together in a fixed relative position.

The other makes use of the cultivator frame as a part of the fertilizer attachment, thus permitting the shifting of the furrow opener to different positions and also the use of different kinds of furrowing shovels or tools. The equipment can be used for various crops, including corn, cotton, and beans, through use of interchangeable seed plates.

Cultivators of both horse-drawn and tractor-mounted types with fertilizer attachments and walking-type, single-row distributors are ordinarily used for side dressing fertilizer to crops at different stages of growth. Side dressing during cultivation combines the two operations and permits placing the plant food below the surface of the soil. In some areas special tractor attachments have been devised for custom work.

Sometimes on irrigated land it is desirable to side dress fertilizer as deep as 6 inches. Tools for the purpose have been developed to deposit the fertilizer in narrow bands with little disturbance of the soil.

The potato planter is one of the types of machines on which the fertilizer side-placement feature was first used. Two single disks are most commonly employed to open a furrow at each side of the row for the fertilizer. Such equipment is available on one-row, horse-drawn planters and two- and four-row tractor-operated planters. Provision also is made for using one disk of regular size and another larger disk, by means of which one band of fertilizer is placed about 2 inches deeper than the other. Or, the fertilizer can either be divided equally between the two bands or a larger amount can be deposited in the deeper band.

Changes with respect to placement have also been made on a number of the single-row, walking-type machines extensively used over a large part of the Cotton Belt. Separate distributing machines have been equipped to deposit the customary amounts of fertilizer in two bands about 6 inches apart. Combination planting and fertilizer-distributing machines have been designed to apply relatively small amounts of fertilizer in a band at the side of the row. In some instances, two or more
of these small walking-type machines have been mounted on tractors.

A newly developed machine applies the usual amounts of fertilizer in the desired position at each side of the row. The planting unit is free to swing to either side as required in following curved rows. The planting unit can also be detached to permit the use of the distributor separately.

A number of conventional machines and some special ones other than those mentioned are now equipped to place the fertilizer at the side of the row. For example, the latest designs of four-row and six-row beet and bean drills permit the placement of the fertilizer about an inch to one side and an inch below the level of the seed. Vegetable crop drills of various sizes also have the fertilizer side-placement feature. Special multiple-row distributors for applying fertilizer in two bands as a separate operation before setting plants have been assembled.

Several methods of placing fertilizer deeply in the soil—intended mainly for heavy applications—have been included in field experiments and used on a number of farms. A part of the fertilizer, however, is usually placed at the side of the row near the seed for immediate benefit to the young seedling.

In one of the deep-placement methods, the fertilizer is deposited in a single narrow band on the bottom of each plow furrow usually at depths 6 to 8 inches below the soil surface. New equipment for this purpose consists of a fertilizer attachment for a wheel-type two-bottom plow. The power required to drive the hopper mechanism is obtained from a separate ground wheel. When the plow bottoms are raised, the wheel is also lifted from the ground and the discharge of fertilizer is stopped.

A modification of the plow-furrow method consists of either broadcasting or drilling the fertilizer on the surface and then plowing the land. In turning the furrow slice, part of the fertilizer reaches the bottom of the preceding furrow and the remainder is held between the furrow slices.

In another method recently introduced, the fertilizer is deeply placed after the land has been plowed. The fertilizer is placed in narrow bands at plow depth or somewhat deeper, usually during the preparation of the seedbed. The machines used for this purpose are deep-tillage cultivators on which suitable fertilizer attachments are mounted. Other adaptable equipment consists of a universal tool bar extending across the tractor on which furrowing tools can be mounted in desired positions.

The deep-tillage cultivators known as chisels, tractor cultivators, and utility cultivators are used for loosening the soil to a depth of 15 inches and deeper under some conditions. The use of these cultivators for applying fertilizer, besides tillage, permits the use of fertilizer hoppers of unusually large capacity and, furthermore, the application of fertilizer deeply in the spring on spring- or fall-plowed land.

The placement of all or most of the fertilizer at plow depth or deeper has advantages under certain conditions, but under other conditions is
not superior to previously approved methods. Further experience is re-
quired to define the conditions under which it is most effective.

For example, under conditions on the Eastern Shore of Virginia, the
recommended side placement of fertilizer produced higher yields of po-
tatoes than placement of all or a major part of it in a band on the bottom
of each plow furrow. In Pennsylvania and New York, however, plowing
under one-half of the fertilizer with the remainder side-placed gave higher
potato yields than placing all of it at each side of the row.

In soil where a dense layer is gradually formed immediately below
the plowing depth, it is necessary to break up the layer to permit water
and plant roots to penetrate it.

Placing and Handling Lime

Types of new machines for breaking the hardpan and loosening the
subsoil include subsoilers, deep-tillage cultivators, and special plows.
Attachments have been developed for applying lime and fertilizer as
required at depths below the ordinary plow furrow. One attachment
is mounted on a wheel-type plow and has a hopper with two compart-
ments, one for lime and the other for fertilizer. A special shoe is attached
back of the plow bottom and extends 4 to 5 inches below the bottom
of the plow furrow during the plowing operation. A part of the lime
and fertilizer enters the special furrow opened in the subsoil.

Another attachment developed for deep, subsoil application of lime
and fertilizer is mounted on a subsoiling machine.

Lime is often distributed over the fields by means of spreading attach-
ments on large trucks in which the material is hauled in bulk from the
railroad car or stock pile directly to the field. The method practically
eliminates hand labor, relieves the farmer of an unpleasant job, and exped-
ites the handling of the material. To some extent the method is also
used in applying fertilizer. The trucks are most commonly equipped with
two rotating horizontal plates at the rear for spreading the material and
a conveyor in the bottom of the truck bed; the conveyor feeds the material
to the scattering plates at the desired rates. Other equipment includes
various types of hoppers with spreaders mounted on the truck or trailed
behind it. In the latter case, hand labor is usually required for transferring
the material from the truck bed to the hopper of the spreading equipment.
The most recent developments include improvements in the conveying
mechanism and spreader plates for more positive operation and more
uniform spreading of the material.

The application of soluble fertilizers with irrigation water has been
practiced in some areas for several years. Special mixing equipment pro-
vides for introducing the desired amount of fertilizer steadily into the
stream of irrigation water.
The application of fertilizer in liquid form with field machines is a recent practice that is not yet extensively used. Equipment for the purpose is essentially a container with some means of regulating the flow of liquid through tubes to furrows in the soil or directly to the soil surface. When the liquid is allowed to flow by gravity from the container to the soil, the flow is regulated either by an adjustable clamp on a rubber delivery tube or by the size of the fixed discharge openings. Gravitational or natural flow decreases as the level of liquid in the container is lowered. To overcome this objection the tank or container has been sealed in such a way that the liquid pressure remains constant as the tank is emptied. The principle is similar to that of common waterers for chickens and livestock. Positive regulation of flow according to the rate of travel of the machine is obtained by means of various types of pumps.

Anhydrous ammonia, and other materials like it, are applied as a liquid under pressure; they change to gas or vapor under ordinary air pressure. The material is stored in heavy steel cylinders. For field-tillage machines, special equipment has been devised so that the compressed gas or liquid is released at a point near the bottom of the furrow. Provision for immediately closing the furrow is essential to prevent the escape of the gas.

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FOR FURTHER READING


National Joint Committee on Fertilizer Application: Methods of Applying Fertilizer, Recommendations of the Joint Committee, Unnumbered Circular, April 1938.

ALSO, IN THIS BOOK

Use of Nitrogen Fertilizers, by F. W. Parker, page 561.