

Machinery Requirements for Separate Fertilizer Placement
by
W. B. Reed

Introduction

The benefit of separating the fertilizer from the seed as it is sown is very attractive with some crops. The best distance of separation though, is quite small, is different for some crops and therefore requires precision equipment with provision for adjustments. This precision limits the kinds of seeding equipment that can be adapted for this purpose. Discer seeding, for example, does not fit into this requirement because of its inability to precisely place the seeds, and of the great difficulty in separately placing the seed and fertilizer. The separate placement concept is therefore limited to seed drills with disc or hoe type openers. The discussion following outlines some of the problems associated with machines and openers for this purpose.

Double disc drill openers

Seed drills with double disc openers have been quite suitable for seeding cereals and other small grains. Their satisfactory operation normally requires a pre-seeding tillage operation for loosening the soil and for control of weeds. Heavy trash though, frequently causes uneven penetration and seeding depth. To avoid too deep seeding the pre-seeding tillage must be shallow since there is the tendency for the double disc openers to penetrate to the previous tillage depth and very little further. The lack of penetrating ability of the double disc opener can be a limiting factor with regard to sidebanding of fertilizer if the fertilizer is to be placed below the seed. It is assumed here that two independent sets of openers are required, one for the seed and the other for the fertilizer. Provision must be made for individual depth adjustment and position to achieve the desired separation. For proper separation of seed and fertilizer, the pre-seeding tillage, in most cases, must be to the depth where the fertilizer is to be placed. Special care is then necessary to avoid seeding too deeply with the seeding placing opener since there is not a firm bottom to limit the depth of the seed opener.

To overcome this problem there are limiting devices (bands) available which attach to the double disc openers used for seed placement. These devices provide only one depth and may have limitations in wet sticky soils. The changing or removal of the bands takes some time if it is necessary to change them when seeding different crops.

The use of two double disc openers in tandem for placing fertilizer directly below the seed will not likely result in separation of the fertilizer and seed unless the depth limiting devices are used for the seed openers.

The use of two sets fixed relative to each other may overcome the above mentioned problems, but there are difficulties of obtaining separation if the two openers are too close together and mechanical problems with sharp turns in the field if too far apart.

Combined double disc and single disc openers

This combination can and is used for side-banding of fertilizer but is not suitable for placing fertilizer directly below the seed. The IH grain drill presently manufactured incorporates this combination with the two openers fixed relative to each other. Four positions of the fertilizer placement opener relative to the seed opener are possible at a fixed distance to one side. This arrangement permits side banding 2.5 cm from the seed with the fertilizer at the same depth as the seed, 5 cm below, 2.5 cm below or 2.5 cm above the seed. These distances depend on maintaining the machine level in the fore and aft direction. Changing the hitch point level will change the vertical separation distance.

This system also requires that the field be pre-worked to the maximum desired depth for either the seed or fertilizer, since the penetration is practically limited to the pre-tillage depth. If not worked deeply enough either the seed or fertilizer will be placed too shallow.

As mentioned, placing of the fertilizer directly below the seed is not feasible with this combination. The rear single concave disc used for fertilizer, if in line with the front double disc opener, would disturb the already placed seed and separation would not be achieved. Using the front double disc opener for fertilizer and the rear for seed is a possible alternative but there is no provision on the machine for doing so. This arrangement would be suitable only where the fertilizer is to be placed below the seed.

Hoe Drills

Modifications to the hoe-openers of hoe-drills appear, at first glance, rather easy to accomplish seed and fertilizer separation. The difficulty concerns the flow of soil, particularly at higher travel speeds. The flow of the soil is also influenced by texture, tilth and moisture content as well as crop residue mixed in the soil.

A split opener design with one side for seed and the other for fertilizer may or may not result in separation. Both the seed and fertilizer tend to bounce when striking the furrow bottom and can be mixed with the soil as it falls into the furrow. Somewhat lumpy or sticky soils are thought to permit more mixing to occur with less separation. Where one half of the split opener is deeper, both the soil and seed can be partly carried down into the furrow for the fertilizer as the soil flows around the opener.

Two separate openers of normal design with one behind the other are advantageous in this regard but must be spaced far enough apart to allow the soil to flow around and fill the furrow. At high speeds filling of the furrow is difficult, particularly with the last or rear row on the machine. The forward rows of openers depend on the openers behind and to one side to move soil laterally to fill the furrow. The seed placed by the rear row may not therefore be properly covered. As with the

split opener, a lumpy soil may not provide separation since the seed and fertilizer can fall down through the lumps reducing the intended separation distance.

The concept of very narrow width hoe opener may hold some promise. It has been reported that if the opener width is 4 mm or less that a slot may be opened which will quickly close with a minimum amount of soil disturbance. This method is to be investigated and will require two openers in a tandem arrangement with independent adjustment provided for the rear opener. Its suitability will not be known until lab and field trials can be carried out.

Summary

The requirements for separate placement fertilizer while seeding are not entirely met by presently available machine. Further modifications are required before the fertilizer can be placed below the seed with both disc and hoe type openers.

The cost of machines to achieve separate fertilizer placement will be considerably higher than the regular seed drills. Additional sets of disc openers and other parts will increase the cost by \$75-\$150 per foot of width. This amount is not excessive provided the anticipated yield increases are obtained. With a 10% increase in yield the extra cost of the seeding equipment would be offset but there has to be the certainty that the yield will be increased. Careful design and use of separate placement equipment is necessary.