Fertilizer Solution Placement with a Coulter-nozzle Applicator for No-till

J.E. Morrison, Jr. and K.N. Potter[1]

ABSTRACT

Evidence from plant nutrient uptake and surface water quality studies indicate that it is preferable to apply fertilizers in concentrated bands below the soil surface. In conservation-tillage situations, this means that the fertilizers should be applied below the surface residues and the biologically active surface soil. Published fertilizer application research from our laboratory indicated that surface soil and residue disturbances could be minimized by the use of a coulter-nozzle applicator for the application of solution-type fertilizers. The coulter-nozzle design consisted of a solid-stream type hydraulic nozzle mounted behind the trailing edge of a smooth rolling coulter so that the stream of fertilizer solution was directed into the open slot immediately behind the coulter. This design, when integrated with depth control wheels and independent applicator unit flotation, provided an implement for shallow fertilizer application in residue-covered soils.

The coulter-nozzle prototypes used in previously reported studies utilized nozzles which did not produce coherent solid streams of solution, especially at higher pressures and higher flow rates. Performance observations were limited to one rate and one travel speed. Preliminary results suggested that 70-80% of the fertilizer was deposited in the first 0-3 cm of slot depth.

The current studies address parameters which may affect fertilizer placement. These include coulter thickness, travel speed, application pressure, and soil water content at time of application. Appropriate solid-stream nozzles have now been selected for improved applicator performance. Nozzles were aimed to have the stream enter the soil slot 5 cm behind the coulter. Coulter thicknesses were 4.4 and 6.4 mm. Travel speed was 6 and 10 km/hr. Solution delivery pressure was 97 and 276 kPa. The site was an undisturbed wheat stubble field, with surface soil water contents of 30.0% MCdb and 25.3% MCdb. Soil was excavated in 2 cm depth intervals to 8 cm and analyzed for the vertical distribution of extractable N by KCL extraction and automated continuous flow analysis. The results are pending and will be presented at the Conference. Anticipated conclusions are that the system is sensitive to the thickness of the coulter but insensitive to the soil condition and operational parameters. Information from this study will establish the fertilizer placement patterns to be expected when the coulter-nozzle applicator and similar commercial applicators are used in tillage studies and field trials.

[1]USDA-Agricultural Research Service, Grassland, Soil and Water Research Laboratory, Temple, TX 76502