have been developed that generate less vibration. The spiral roller/crimper (Figure 9.3a) does not generate adequate force to kill the plant, so supplemental herbicide application is necessary. Newer designs have a smooth roller to flatten the cover crop and a separate bar that crimps the cover crop at regular intervals, moving up and down as the roller goes forward (Figure 9.3b).

Some roller/crimpers have been designed specifically for raised-bed vegetable production. Figure 9.4a shows 8-foot wide equipment that simultaneously terminates cover crops on two row tops and three furrows. Figure 9.4b shows equipment that simultaneously terminates one row top and two furrows.

Figure 9.4c shows a 6-foot-wide two-stage roller/crimper designed to operate with smaller tractors (40 horsepower). Note this roller is not for raised beds. The 12-inch-diameter smooth drum flattens the cover crop and the 6-inch-diameter drum has six equally spaced, quarter-inch thick crimping bars on its surface. By adjusting the springs on either side of the small drum, the crimping force can be tailored to the cover crop and amount of biomass.

The two-stage roller/crimper has proven to be as effective as the original straight-bar roller. The percentage of the rye killed with the two-stage roller/crimper was the same as the straight-bar roller one week after rolling/crimping and better than the straight-bar roller two and three weeks after rolling/crimping (Figure 9.5).

TABLE 9.1. The amount of glyphosate spray solution and glyphosate formulation used for different treatments and termination achieved

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Glyphosate spray solution applied (qt/ac)</th>
<th>Glyphosate formulation applied (qt/ac)</th>
<th>Glyphosate formulation amount of continuous spray, percent</th>
<th>Rye termination one week after rolling, percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous spray</td>
<td>59.5</td>
<td>1.0</td>
<td>100</td>
<td>100 97 99</td>
</tr>
<tr>
<td>Spray every other crimp</td>
<td>17.2</td>
<td>0.3</td>
<td>29</td>
<td>97 94 97</td>
</tr>
<tr>
<td>Spray every fourth crimp</td>
<td>7.6</td>
<td>0.1</td>
<td>13</td>
<td>99 84 96</td>
</tr>
</tbody>
</table>

1 The continuous spray application was calibrated to apply 1 quart (32 fluid ounces) of the glyphosate formulation per acre.
Fine-textured soils sometimes stick to and accumulate on the shank, disturbing too much soil and making the slit too wide. This can impede planter operations and is referred to as “blowout.” Plastic shields that fit over the shank prevent soil from sticking, therefore minimizing blowout (Figure 9.11).

Another way to reduce blowout is to install splitter points on the subsoil shanks. The splitter points look like shark fins that attach vertically upright to the tips of the shank points (Figure 9.8 and Figure 9.12). They fracture the soil at the bottom of the trench, preventing soil upheaval to the soil surface. The modifications discussed in this section are primarily for older-model in-row subsoiling equipment. Current equipment incorporates these modifications to improve performance in high-residue situations.

## NO-TILL PLANTERS FOR FIELD CROPS

The objective when no-till planting in cover crop residues is adequate seed-to-soil contact at a desired seeding depth. Planters designed for operation in residues are heavier than conventional planters. The additional weight allows the planter to maintain the desired seeding depth in rough soil conditions and prevents the planter from floating across the soil surface, which results in uneven seed placement. Individual planter row units are typically equipped with heavy-duty down-pressure springs to maintain seeding depth in uneven soil conditions. In extreme cases, additional weight can be added directly to the planter.

Row cleaners sweep residue away from the opening disks of the planter units. They are useful when planting in heavy cover crop residue. There are different types of row cleaners for different types of planters (Figure 9.13).

Removing residue near the row reduces the chance of hairpinning. Adjust row cleaners to move residue without digging into the soil. If too much soil is disturbed, it will dry out and may crust over, which hinders emergence. In addition, disturbed soil can promote weed emergence in the row. Setting row cleaners too deep will cause residue to wrap around the row cleaners, which affects planting depth and seed coverage. Position row cleaners so that they rotate and “brush” residue away from the seed furrow.

When growing cotton after rye in a no-till system, the best cotton stand is obtained by rolling/crimping parallel to the cotton rows and using a