RESEARCH UPDATES

Evaluating Seed-covering Devices and Presswheels for Directly Seeding Mustard and Cabbage

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Additional Index Words. Brassica oleracea, Brassica juncea, emergence, precision seeding

Summary. Stands of brassica crops obtained with precision seeders are sometimes inadequate or nonuniform. Although several types of covering devices and presswheels are available from precision seeder manufacturers, the effects of covering devices and presswheels on plant emergence of direct-seeded Brassica crops have not been determined. In Spring and Fall 1996, six crops of mustard (Brassica juncea (L.) Czernak) and four crops of cabbage (Brassica oleracea L. capitata group) were direct seeded with a precision belt seeder using four covering devices and four rear presswheels. All of the covering devices and presswheels evaluated were adequate for direct seeding mustard and cabbage under the soil moisture conditions and soil type (silt loam or fine sandy loam) found in these experiments. Although poor stands were obtained with all seed covering devices and presswheels when 7.8 inches (199 mm) of rain occurred within 3 days of planting, plant stand of cabbage was greater when the paired arm device was used than with dragtype or no covering devices.

A uniform stand is often difficult to obtain when direct seeding Brassica crops. Perkins-Veazie et al. (1989) noted that problems with soil crusting, high humidity, temperature extremes, and pathogen attack limit the use of direct seeding of cabbage in Florida. Johnson and Wilcox (1977) noted that emergence problems limited the adoption of direct seeding for some vegetable crops. Parish et al. (1992, 1995) reported on several years of research using precision seeding for commercial vegetable crops. Many of the research plots in those experiments had to be replanted due to insufficient stands that were associated with equipment insufficiency or weather conditions following planting (personal communication).

Akyurt and Taub (1966) developed a precision seeder for sugar beets (Beta vulgaris L.) that provided two-point seed contact with the undisturbed capillary system of the soil and a seed cover consisting of a porous and dry top soil layer. Inman (1968) reported on precision planting equipment and aids for vegetable crops. His report dealt primarily with precision metering and did not discuss seed covering or seed-to-soil contact.

Abernathy and Porterfield (1969) evaluated the effect of planter opener shape on furrow characteristics and found that the planter openers reduced soil density to a depth greater than the operating depth of the opener. They did not evaluate covering devices, presswheels, or their effects on seed emergence. Cochran et al. (1974) conducted soil bin studies on planter furrow openers and depth control devices to establish quantitative relationships for design of depth gauging devices on planters but did not relate their work to seed emergence.

Hudspeth and Wanjura (1970) developed a planter to improve emergence of cotton seed (Gossypium hirsutum L.). The planter was not outfitted with a presswheel but had a seed firming wheel in the furrow ahead of knife coulters. They reported increased emergence compared with a commercial cotton planter that used presswheels.

Wurr and Fellows (1985) evaluated the effects of different seeding depths and presswheel pressures on emergence and growth of lettuce (Lactuca sativa L.). Presswheel pressure had no effect on emergence or growth. Shallower seeding depths were most effective.

Conclusion

MGs can be effective competition judges for vocational horticulture events in 4-H as well as the traditional youth events in 4-H and consumer horticulture areas. It is a mutually rewarding experience for MGs and the student contestants and can also match the MG educational goals. Prior youth program or judging experience is not a requirement when training is provided, preferably in multiple formats, to prepare the MGs in the procedures and scoring standards of the event.

Literature cited


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when seeding was followed by a rain and soil moisture was kept near optimum. Under drier soil conditions, deeper seeding was more effective.

Morrison and Gerik (1985a, 1985b) developed simulation models to predict emergence of wheat [Triticum aestivum (vulgare) L.], soybeans [Glycine max (L.) Merr.], alfalfa (Medicago sativa L.), and grain sorghum [Sorghum vulgare (L.) Moench] with different presswheel designs. They determined that depth-control wheels beside the openers were most effective, but the width of the depth-control wheels precluded the narrow row planting configurations needed for most vegetable crops. They also conducted field experiments to evaluate depth-gauging wheels on planters. The field tests confirmed that wide, dual-side wheels worked well, as did experimental narrow linked front-rear gauge wheels. Morrison (1989) determined that improved emergence of crops depended on good planting depth control, limited in-row starter fertilizer rates, and proper selection of rear presswheels and downforce on those presswheels.

Richey (1981) discussed the development of a commercial agronomic planter for precision metering by vacuum. The development of furrow-forming shoes and ribbed presswheels reduced emergence time for corn (Zea mays L.) by one-third in many cases.

Parish et al. (1991) compared belt and vacuum precision seeders in the laboratory and in the field. Plant-spacing uniformity with nonspherical seeds was better with vacuum seeders. Poor emergence of cabbage, broccoli, onion, and spinach was noted with all seeders in some plantings.

Price and Taylor (1994) evaluated the precision spacing of snapbean seed (Phaseolus vulgaris L.) by vacuum planters and found poor seeding uniformity with all four models tested. They correlated emergence with yield and found those plants with early emergence yielded twice as much as those with late emergence.

Bracy et al. (1993, 1995) and Bergeron et al. (1992) measured plant spacings of cabbage and cauliflower directly seeded with different nominal seed spacings and found that seeding directly to the desired stand, rather than over-planting and thinning, was possible and practical. They reported that when plantings did not result in an adequate stand, all treatments were affected with no advantage to the heavier seeding rate (Bergeron et al., 1992).

Hegarty (1979) reported that preemergence losses of broccoli in the field were due in part to the inability of seedlings to emerge from the soil (soil impedance) and in part to biotic factors. Factors over which the grower has some control (soil tilling, fertilizer level, and seedling performance) have more effect on plant stands than soil temperature or soil moisture (Hegarty, 1976). He noted that “the more extreme reductions in emergence levels in all crops seem to be associated with soil structure problems associated with the sowing operation itself, or with rainfall after sowing.”

The objective of this study was to evaluate effects of seed covering devices and presswheels on the plant stand of directly seeded mustard and cabbage.

Materials and methods

Ten experiments were conducted at the Hammond Research Station, Hammond, La., on a soil classified as a Cahaba fine sandy loam soil (thermic Typic Hapludult) during Spring and Fall 1996. Plantings were made in four locations on the station on 15 Mar., 3 Apr., 20 Aug., 24 Oct., and 5 Nov. with mustard and on the same dates, except for 3 Apr., with cabbage. Planting times and field locations were varied in an attempt to assess planter component performance under different soil moisture conditions and texture. Fields were prepared and planted in the same manner for all plantings using the precision system developed by Parish et al. (1992). The crops were planted on precision-shaped raised beds spaced 40 inches (1.0 m) on center. The beds were nominally 6-inches (152 mm) high with a flat top. As the crops were not grown to maturity, no fertilizer, herbicide, or supplemental irrigation was applied to the test area.

A precision seeder (Stanhay model S870; Hestair Farm Equipment, Suffolk, England) was equipped with combinations of four covering devices and four rear presswheels for a total of 16 treatments. Covering devices included standard drag [0.6-inch (16-mm) square steel bar], light drag [0.4 inch (10-mm) square steel bar], paired arms [0.24 × 1.2-inch (6 × 30-mm) steel paddles], and no covering device (Fig. 1). Presswheels included standard smooth steel banded [4.5-inch wide × 9.0-inch diameter (114 × 229-mm)], concave split [3.5-inch wide × 10.8-inch overall diameter (89 × 273-mm)] with 0.5-inch (13-mm) space between conical wheels, flat split [4.5-inch wide × 9.0-inch diameter (114 × 229-mm)] with 1.0-inch (25-mm) space between wheels, and cage [4.5-inch wide × 9.0-inch diameter (114 × 229-mm), covered with expanded steel mesh] (Fig. 1). All presswheels and covering devices (with the exception of the light drag) are stock parts available with the Stanhay seeder.

Fig. 1. Press wheels (top row) and seed covering devices used for direct seeding mustard and cabbage.
The light drag covering device (a replica of the standard drag with a smaller drag bar) was fabricated in the university's shop.

'Savannah' (Sakata Seed America, Morgan Hill, Calif.) or 'Florida Broadleaf' (local source) mustard was planted using a single-line belt and single-line opener with a nominal seed spacing of 2.7 or 3.3 inches (68 or 84 mm). The March planting date also included a planting of mustard using a two-line belt and two-line opener at a 1.5-inch (39-mm) nominal seed spacing. The two-line configuration is the preferred method for growing mustard, but in later plantings this configuration was not included to reduce the number of component and seed hopper changes. At all planting dates except the April date, 'XPH 598' cabbage (Agrow Seed Co., Kalamazoo, Mich.) was planted using a single-line belt and single-line opener with an 3.3-inch (84-mm) nominal seed spacing. Cabbage was not planted at the April planting date due to timeliness in obtaining seed. All treatments were replicated four times in a randomized block design.

Soil samples [3 inch (76 mm) deep in the center of the bed top] were taken at planting to determine soil moisture. Additional soil samples [6 inch (152 mm) deep] were taken in each field for particle size analysis and verification of texture class. Precipitation for the first 15 d following planting was recorded. Plants were counted when emergence appeared complete, >2 to 3 weeks after planting. Data were analyzed using an ANOVA procedure in CoStat Statistical Software (CoStat, 1995).

**Results**

At the March, April, August, and October planting dates, soil moisture was optimum, ranging from 8.0% to 11.2%, at or slightly below field capacity (Table 1). Soil moisture at the Novem-
Table 4. Influence of covering devices and presswheels on plant population of cabbage at four planting dates, Hammond, La., 1996.

<table>
<thead>
<tr>
<th>Seeder component</th>
<th>Plants/acre (ha) [1000s]</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>March</td>
</tr>
<tr>
<td>Covering device (CD)</td>
<td></td>
</tr>
<tr>
<td>Standard drag</td>
<td>136 (55)</td>
</tr>
<tr>
<td>Light drag</td>
<td>153 (62)</td>
</tr>
<tr>
<td>Paired arms</td>
<td>141 (57)</td>
</tr>
<tr>
<td>None</td>
<td>119 (48)</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
</tr>
<tr>
<td>Presswheel (PW)</td>
<td></td>
</tr>
<tr>
<td>Standard smooth</td>
<td>131 (53)</td>
</tr>
<tr>
<td>Concave split</td>
<td>158 (64)</td>
</tr>
<tr>
<td>Flat split</td>
<td>126 (51)</td>
</tr>
<tr>
<td>Cage</td>
<td>133 (54)</td>
</tr>
<tr>
<td>Significance</td>
<td>NS</td>
</tr>
<tr>
<td>CD × PW</td>
<td>NS</td>
</tr>
</tbody>
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*NS = Not significant or significant at P ≤ 0.05, respectively.


