



# Strip Intercropping: A CRP Conversion Option

## SUMMARY

- Strip intercropping can result in higher yields and profitability than monocropping systems.
- Sound weed management and the ability to successfully manage a broad range of crops are critical for this system.

Strip intercropping is the practice of producing two or more crops in narrow strips located throughout the length of the field. The strips are wide enough that each can be managed independently, yet narrow enough that each crop can influence the microclimate and yield potential of adjacent crops. Crops are rotated annually.

Strip intercropping use is normally based on agronomic and/or environmental considerations. A well-managed strip intercropping system results in higher crop yields and greater profitability than monocropping systems. Environmentally, a well-designed system has greater soil and water conservation potential than most monocropping systems.

This system allows for production advantages offered with crop rotation and reduces the problems associated with continuous no-till corn, the other row crop alternative for highly erodible land. The good crop manager is encouraged to use strip intercropping on land previously enrolled in CRP. Sound weed management is critical to this system, as is the ability to successfully manage a broad range of crops. Machinery size for each field operation must be compatible between crop strips.

### Agronomic Considerations

Design strip intercropping systems based on individual farm needs and goals. Crop selection, strip width, planting direction, plant populations, and strip orientation are management options that may vary from farm to farm. As an example, a three crop system (corn, soybean, and oats) will be discussed.

### Corn

Corn is a good candidate for strip intercropping because of its strong yield response to field edge effects. It utilizes high sunlight levels more efficiently than either oats or soybeans. Edge rows frequently produce corn yields 10 to 30 percent higher than strip centers (figure 1). Greater yield differences are possible with increased corn population in the edge rows. The greatest edge effects seem to occur when conditions are favorable for high yields. Good soil, favorable weather, and good management give the greatest border row yield advantages.

Increased corn yield is the greatest production opportunity for strip intercropping systems. Management considerations for this high yielding environment are different from those for monocrop field systems. High populations (35,000 to 50,000 plants/acre) on the outside rows are appropriate on good soils, if uniform plant spacing within the row can be maintained.

Twin row planting is an alternative to single row planting for high populations. Where one row normally would be planted, two rows are planted four to five inches apart. This ensures less plant crowding within the row and works best with no-till. Two planter passes are required for this configuration. If between-row spacing (for each twin row combination) is kept to no more than five inches and lodging is not a problem, harvesting can be done with a conventional combine head.

Fertility management also varies across the strip. Edges have higher yields and greater nutrient demands on the soil. Corn nitrogen demands are higher in the higher-yielding edge positions, suggesting that a higher nitrogen fertilizer application for the edge

rows is appropriate. However, the optimum rates have yet to be determined; a 10 to 20 percent increase in nitrogen fertilizer application in this position is suggested.

#### Small grains

In various trials, small grain yields also increased on strip edges, as compared with strip center positions. This increase, however, was not as dramatic as that observed for corn (figure 2). Because oats are typically planted one month or more before corn and soybeans (the adjacent crop strips in this example), less competition exists for edge plants than for plants in the strip center position. By the time corn and soybeans have advanced enough to compete with the small grain, the small grain requires less water, nutrients, and sunlight. As the small grain approaches maturity, the taller corn plants serve as a wind shelter, reducing small grain lodging. The reduced wind flow also can slow small grain drying, particularly if it is windrowed prior to harvest.

#### Soybeans

Soybean yield in the row adjacent to the corn strip is typically reduced 5 to 10 percent, as compared with yield in the strip center

(figure 3). Growing only corn and soybeans in the strip system results in two soybean rows with yield reductions in each strip. In a three crop system, soybean yield increases with distance from the corn strip, with the highest yield occurring next to the oat strip (for strips that are no wider than six rows). Yield increases are attributed to a wind shelter effect from the taller corn plants. For wider strips, yield increases are not expected beyond the sixth or eighth row from the corn edge. Under drought conditions, water stress occurs next to the oat strip, resulting in lower soybean yields in this position than in the strip center. However, higher soybean yields are produced next to the corn strip, which serves as a shelter that reduces transpiration demands on the soybean plants. Generally, soybean yields in the three crop strip system are similar to or slightly lower than those observed in monocropped fields.

#### Weed control

Weed control is of utmost importance in strip intercropping systems. Herbicide programs are suitable for this system if susceptible crops do not receive drift, and if carryover is not a problem. Application precision is more

Figure 1. Effect of corn row position (for a six-row strip) on corn yield, expressed as a percent of yields typically observed with monocrop corn management. The number on top of each column indicates the range of yields (compared with monocropped yields) observed at each position.

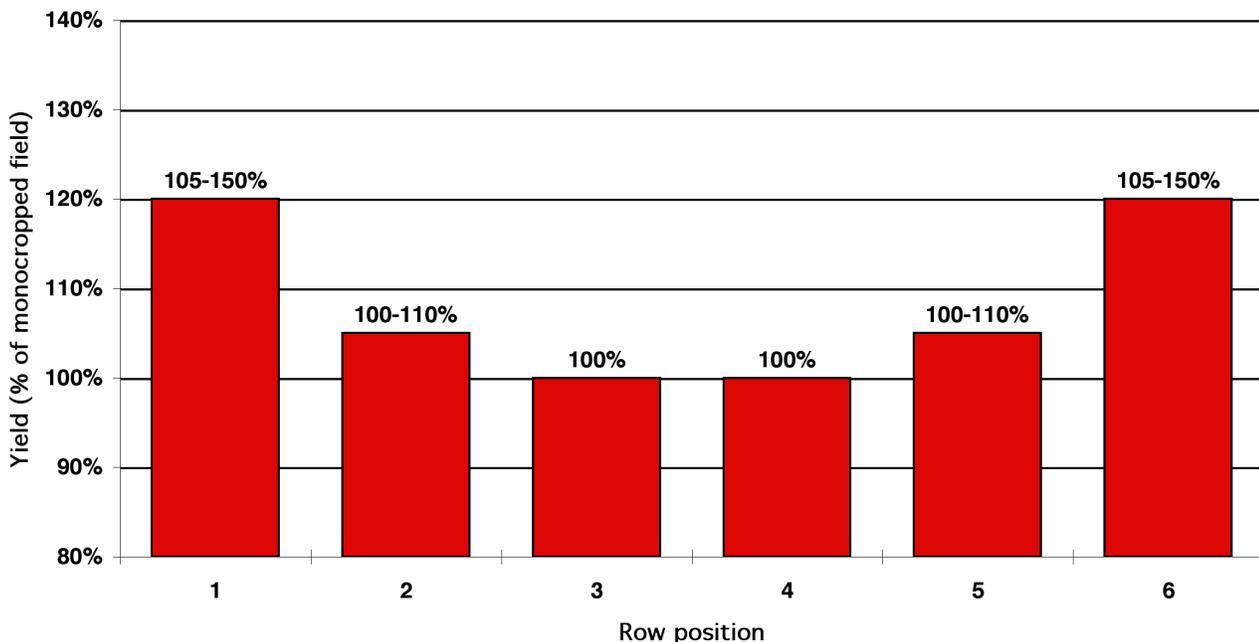


Figure 2. Effect of position in an oat strip (for a 15-foot-wide strip) on yield, expressed as a percent of yields observed in monocropped oat fields. The number on top of each column indicates the range of yields typically observed at each position. Position 1 is next to corn. Position 6 is next to soybeans.

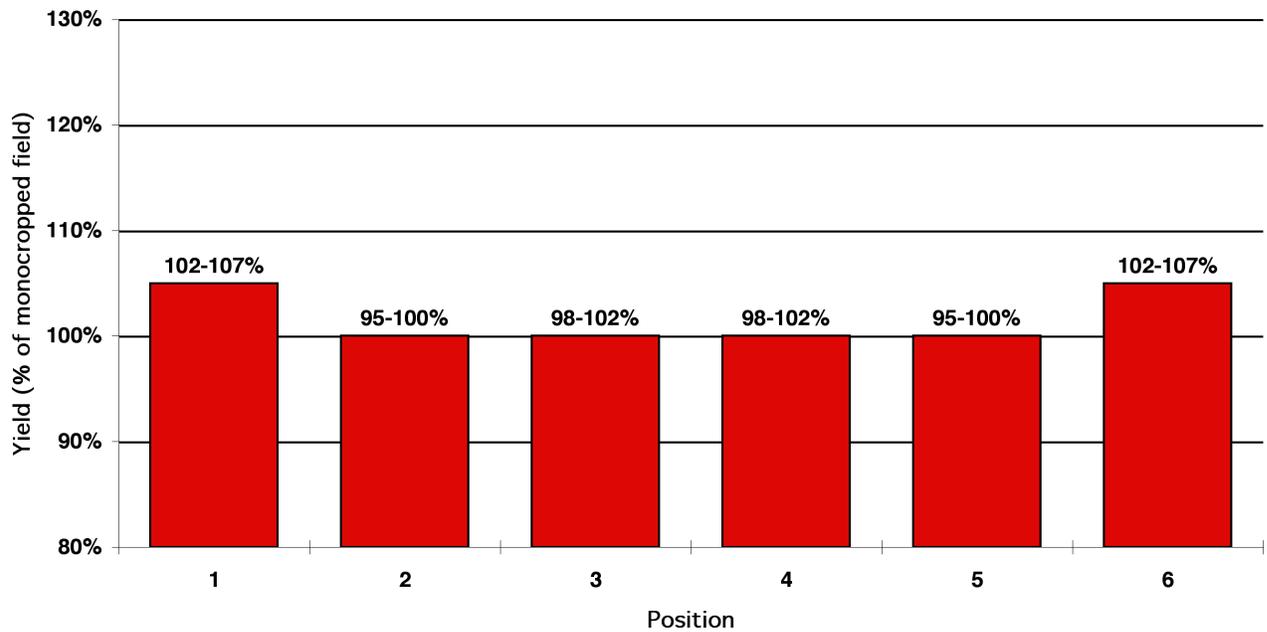
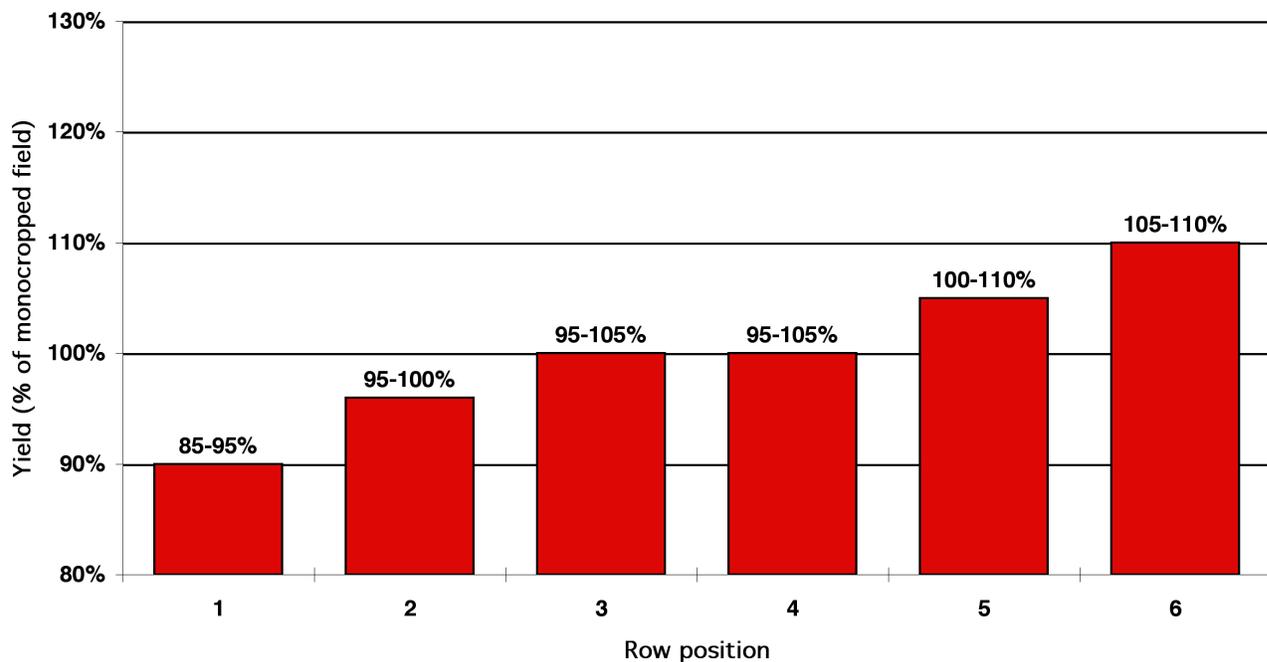


Figure 3. Effect of soybean row position (for a six-row strip) on yield, expressed as a percent of yields observed in monocropped soybean fields. The number on top of each column indicates the range of yields typically observed at each position. Row 1 is next to corn. Row 6 is next to oats.



This bulletin is part of a series to help CRP contract holders assess the land-use options available to them when the contracts expire. The series was funded in part by the Leopold Center for Sustainable Agriculture. Other bulletins in the series and additional information are available at county ISU Extension offices.



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important with strip intercropping than with other systems. Weed control in the crop strip border position is critical. The interface between the small grain and the row crops is particularly vulnerable to grasses, such as fox-tail, after small grain harvest. Light intensity is greater at the edge of the strip than it is under the crop canopies. While this favors increased crop production, weed growth also is favored. Possible management alternatives include mowing or spot spraying with glyphosate or a comparable product. A four-wheeler and a hand-held sprayer works well for such an application.

### Strip direction

Strip direction influences the microclimate, particularly on the strip edges. Soybean and oat yields seem less sensitive to strip direction than corn. With east-west oriented strips, corn yield typically increases on the south border row, with the north border showing small, if any, yield increase. North-south oriented strips favor corn yield increases on both strip edges.

### Environmental Considerations

Strip intercropping offers unique opportunities to manage soil and water resources within a high yielding system.

### Reduced pesticide and fertilizer application

Because several crops are present in a field, the total pesticide or fertilizer applied at one time is less than that which would occur if only one crop were present. This reduces the chances for large pesticide or fertilizer loss associated with heavy rainfall shortly after application.

The small grain strips dispersed between the corn and soybean strips are suitable for summer manure application after small grain harvest. This reduces or eliminates the need for fall, winter, and/or spring manure application, when nutrient losses are more likely to occur and when soils are more susceptible to compacting. Some producers interseed a legume with the small grain for nitrogen fixation. As corn is rotated into this strip, nitrogen fertilizer requirements of the corn are reduced.

### Soil erosion

Soil erosion is limited with the strip intercropping system, particularly if the system contains small grain and/or forage strips. Three management factors influence this characteristic.

- 1) Because strip position should be fixed from year to year, no-till or ridge tillage, which also conserves soil, is best suited for the system. With these tillage systems, planting position is easily identified each year based on the residue and row location of the previous year.
- 2) Contour planting on highly erodible land further reduces soil erosion losses.
- 3) The small grain/forage strip serves as an efficient vegetative filter for sediment removal from runoff water. Vegetative filters work well in this capacity if runoff water enters the strip as sheet flow. Placing the small grain strips on a hillside results in water entering the strip as sheet flow more frequently than that which occurs if the vegetative filter is at the field edge. Research in southwest Iowa indicates soil conservation with no-till strip intercropping of corn, soybeans, and winter wheat is comparable to continuous no-till corn on slopes of 12 to 14 percent.