AGRONOMIC CONSIDERATIONS FOR SUCCESSFULLY RELAY INTERCROPPING SOYBEANS INTO STANDING WHEAT IN THE SOUTHERN UNITED STATES

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INTRODUCTION

Double-cropping wheat and soybeans is a popular cropping system across the southern U.S. Producers, however, are challenged by high costs, price volatility, and weather extremes, which reduce profit potential, especially for soybeans. For improved production efficiencies and for meeting conservation compliance requirements on highly erodible fields, new environmentally sound and cost-effective reduced-tillage ideas should be examined.

Relay intercropping or inter-seeding soybeans into standing wheat is a concept that has been explored in the Midwest as a means of extending the growing season to facilitate double-cropping (Chan et al., 1980; Duncan et al., 1990; Jeffers, 1984; McBroom et al., 1981a, b; Moomaw and Powell, 1990; Reinbott et al., 1987; and Wendt and Nave, 1979). In the South, intercropping has been examined recently in Mississippi (Buehring et al., 1990) and South Carolina (Khalilian et al., 1990; Hood et al., 1991; Hood et al., 1992; Khalilian et al., 1991; Khalilian et al., 1988; Whitwell, 1991; and Wallace et al., 1992) because of its reduced input features (e.g. for energy, labor, equipment, and herbicides). In addition, the emphasis on conservation-tillage technology has driven researcher and producer interests in this concept.

Since 1988, Clemson University researchers have investigated many of the equipment, energy, and crop and soil management factors associated with intercropping soybeans and wheat. This paper outlines some of the advantages of intercropping, recent research findings, and guidelines for successful on-farm adoption of the system.

ADVANTAGES

Conventional double-cropping, a sequential planting of soybeans after wheat harvest, is often fraught with poor stands, weed infestations, and delayed soybean planting due to adverse weather. With relay planting, soybeans are inter-seeded into wheat 1 to 3 weeks before wheat harvest. This concept has the following potential advantages over conventional double-cropping systems:

a) better utilization of soil moisture for soybean stands;
b) optimum planting time for soybeans;
c) lower energy requirements;
d) less soil erosion and runoff, and better water quality;
e) reduced soil compaction;
f) less herbicide use; and
g) more timely field operations for soybeans, including planting, spraying, and harvesting.

RECENT RESEARCH FINDINGS

When inter-seeding, both crops are planted with a special inter-seeder drill developed by Clemson agricultural engineers and currently commercially available from Valkenburg Equipment Co., Greenwood, SC. The drill plants 11 rows of wheat (13-inch spacing) in the fall, leaving two traftic lanes (24 inches) for wheel traflic (76-inch spacing). This pattern allows for the inter-seeding of eight rows of soybeans in mid- to late-May (soil moisture permitting) when wheat is in the hard dough stage, about 2 to 3 weeks before harvest. There is also an inter-seeder drill configuration available for wheel traftic with a 96-inch spacing. However, since most tractors are setup with the 76-inch wheel spacing, the former scheme is the most popular so far in on-farm producer trials. (Note: see paper by Hood, et al. in this conference proceedings for illustrations of the inter-seeding schemes and planter setups).

The following is a list of findings from the Clemson intercropping research effort, which will impact producer acceptance of this planting concept.

1. Crop yields

Yields of wheat in the wide-row pattern for inter-seeding have been no different from wheat planted in conventional drill spacings in Coastal Plain soils (Khalilian et al., 1990). In soils typical of the Piedmont

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region, however, yields of wheat were 15 to 20% lower due to reduced tillering in the wide-row scheme (Wallace et al., 1991).

For soybeans, yields were significantly higher for inter-seeding vs. conventional no-till subsoil planting in 38-inch rows after wheat harvest in the Coastal Plains (Khalilian et al., 1991). For Piedmont conditions, yields of inter-seeded soybeans have been at least as high as drilled mono-crop soybeans or conventional wide-row no-till soybeans planted after wheat harvest (Wallace, et al., 1992 and Hayes, et al., 1991).

2. Deep tillage

Research at Blackville, SC in Coastal Plain soils indicates that the need for deep tillage before planting soybeans is eliminated if a good job of deep tillage is done before wheat planting in the fall. Then, if the controlled-traffic pattern is utilized with inter-seeding, a savings of $8 to $10/A is possible (Khalilian, et al., 1991).

3. Weed management

Field observations have shown that, with inter-seeding, herbicide inputs are less in most cases vs. conventional wide-row double-cropping systems (Whitwell, 1991).

4. Crop growth

Even though inter-seeded soybeans often show an etiolated or spindly appearance due to shading from the wheat crop before and for some time after wheat harvest, research has shown no difference in yield between an inter-seeded crop and mono-crop soybeans planted the same day (Wallace et al., 1992).

5. Equipment technology

New drill technology (e.g. Airseeder, Yetter seeder-coulter, etc.) has enhanced field success and producer acceptance of inter-seeding as an alternative to conventional double-cropping systems (Hood, et al., 1992).

GUIDELINES FOR SUCCESS

To optimize yields and returns from intercropping soybeans and wheat, the following guidelines are suggested.

1. Field selection

Choose fields for intercropping that are relatively free of perennial weeds and grasses, hard-to-control broadleaf weeds, or nematodes parasitic to soybeans. Soils present should have productive potential for high crop yields, eg. at least 50 bushels for wheat and 30 bushels for soybeans.

2. Deep tillage and controlled traffic (wheat)

If soil hardpans or traffc pans exist, practice deep tillage before planting the wheat. In the light-textured Coastal Plain soils, deep tillage with a chiselplow or Paratill 1 to 2 inches into the B horizon (clay) will provide optimum crop yield response. It is important that trips across the field be minimized for application of topdress nitrogen and/or pesticides for wheat. If possible, all wheel traffc should be confined to the wheel tracks set up when planting wheat in the fall.

3. Wheat variety

Select an early- or mid-season high-yielding wheat variety with good disease resistance and strong straw strength. Successful interseeding is difficult if the wheat is badly lodged.

4. Wheat seeding rate

The seeding rate for wheat should be the same as for conventional drilled plantings.

5. Weed control (wheat)

Since there may be more winter weed pressure due to the wide-row spacing (and due to spacing for wheel tracks), weed scouting should be done during the wheat tillering stage. Herbicide(s) should be selected based on target weeds present.

6 Nitrogen topdress/herbicide application for wheat

All nitrogen topdress and herbicide (or other pesticides) application trips should be accomplished with equipment set up in the same wheel spacing (76- or 96-inch) as the interseeder drill.

7. Soybean variety

A fast-growing high-yielding Group VII or Group VIII soybean variety should be chosen. If nematodes are known to exist in the field, select a variety with resistance, if available.

8. Interseeding soybeans

Plan to interseed soybeans at approximately 3 to 4 seed/row ft from May 10 to May 31, when wheat is in the hard dough stage of growth, and about 2 to 3 weeks from harvest maturity. Since wheat is also using soil moisture at high rates during this period, it is very important to plant in moisture adequate for germination and emergence. Shortly after soybean emergence, the seedlings will become etiolated (spindly) while growing in the shade of the wheat, Once the wheat is harvested in early June, the soybean plants quickly outgrow the effects of early shading by wheat.

9. Wheat harvest

The wheat should be harvested as soon as possible after harvest maturity and ideal seed moisture are reached. If combine wheels do not match the wheel traffic pattern, harvest at an angle or perpendicular across the crop rows. Combine wheel traffic will not significantly damage soybean stands during the first 3 to 5 weeks after planting. During harvest, the wheat straw should be chopped and spread evenly across the combine swath. Or, if feasible, curtains can be attached to the rear of the combine to force all straw into the wheel tracks.

10. Weed control (soybeans)

After wheat harvest (ASAP), scouting should be done to assess the weed situation, i.e. species, size or stage of growth, intensity, etc. Postemergence herbicide(s) should be selected based on scouting results for each field, and applied according to label directions. Use application equipment set up in same wheel spacing (76- or 96-inches) as the interseeder drill.

11. Costs and returns

Table 1 is a production costs and return comparison of intercropping vs. conventional and no-till drilling of soybeans after wheat harvest. These are based on 1992-93 enterprise budgets from the Clemson University Applied Economics Department.

As mentioned earlier in this paper, it is likely that producers can obtain higher interseeded soybean yields than for conventional double-crop systems. In such cases, more income (profit) would be possible.

Table 1. Wheat (50 bu/A) and soybean (30 bu/A).

	Conventional tillage	No-till	Interseed
Revenue*	**$365**	**$365**	**$365**
Variable costs	**215**	**213**	**216**
Income above variable costs	**150**	**152**	**149**
Fixed costs	**54**	***46***	**46**
Land charge	**30**	**30**	**30**
Overhead **(8%** V.C.)	**17**	**17**	**17**
Total costs	**316**	**306**	**309**
Income above total costs	**49**	**59**	**56**

* Wheat price = $3.00 + $1.00 def. payment and soybean price= $5.50/bu.

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