Use of New Genotypes of Small Grains and Soybeans in Conservation Tillage Systems

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INTRODUCTION

The use of small grains and soybeans *(Glycine max* [L.] Merr.) in a double cropping scheme is one of the most popular conservation tillage systems used in the Southeast. Both crops can now be planted with limited tillage, and the opportunity of high yields and good profit margins are readily available. New genotypes of both small grains and soybean are released each year which have significant improvements that make them good choices in conservation tillage systems and will enhance the opportunity for profit utilizing these systems.

One of the most exciting and useful new developments is the availability of new soybean varieties with genetic resistance to the broad-spectrum herbicides. They allow growers to simplify weed control programs and manage weeds with one or two applications of a single herbicide. Weed control is not very costly with the small grain portion of this system, and genetically engineered small grains with broad-spectrum herbicide resistance are not yet available, but quite likely will be available in the future.

SMALL GRAINS

Wheat *(Triticum aestivum* L.). The small grain portion of this double cropping system can be quite risky if poor choices are made with variety selection. If you choose varieties that are susceptible to diseases or insects, major yield and quality reductions can occur. When wheat is used, it is very important that the newest varieties have good resistance to leaf rust powdery mildew, and Hessian fly *(Phytophaga destructor).* After a wheat variety has been grown on a large acreage and exposed to diseasee epidemics over a period of time, it will become susceptible to these diseases. So it is important to use new varieties before the disease organisms have had a opportunity to change and more virulent strains become prevalent.

Another factor to consider in selecting wheat varieties is maturity. Some excellent early varieties are available and do very well at later planting dates (after 1 December). However, they are quite susceptible to damage from a late season freeze if planted early because they head early in the spring and are not cold tolerant after they have begun jointing. Normally, early maturing varieties would be preferred in double-cropping systems because it is important to harvest the crop early in order to get the second crop planted in a timely manner. Late maturing varieties usually perform well if they are planted early (in November), but they can have problems if planted late. In a mild winter, these late maturing varieties will not receive enough chilling hours for vernalization if they are planted late. They do not head properly or head late and are filling the grain during high temperatures. It is risky to take wheat varieties foo far from the region where they were developed.

Oat *(Avena sativa* L.). Another small grain that works well in conservation tillage systems is oats. Oats are well adapted and are very valuable in a diversified farming operation, particularly one that includes livestock. Oats are an excellent feed grain that can be used in a number of animal rations. They are also an excellent forage crop and can be used for winter grazing or even as hay or a silage crop. Oats are very nutritious and animals perform very well when consuming oats, either the forage or the grain. Oat has a reputation, undeserving in our opinion, of not being winter hardy and thus very risky to grow. We have grown oats quite successfully in 25 of the last 27 yr here in North Florida. Oats were severely damaged in 1984 and 1985 during the cold winter that moved the citrus industry at least 50 miles south in Florida. Oats occasionally suffer some leaf bum during cold periods but they normally recover quite rapidly.

Data to illustrate the performance of some of the newer oat varieties is presented in Table 1. Both the 'Chapman' and the 'Harrison' varieties are winter hardy and have excellent resistance to crown rust, the most important production hazard. Chapman is a relatively short variety that should work particularly well in conservation systems.

Rye *(Secale cereale* L.). Rye can also be used in conservation tillage systems and seems particularly popular when used just as a cover crop in the winter and as a mulch for the second crop. Our Southeastern ryes are early maturing and normally stem up early in the spring and are well suited for early planting dates for the second crop. Rye can also be grown as a seed crop and followed very successfully with soybean. Variety

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selection is not as critical with rye as with wheat or oat but if you want to grow it as a seed crop, variety selection would be important. You should select a variety that is popular among forage producers so that you could easily sell the seed. It is also important to select an early maturing variety and one that is resistant to leaf rust. 'Wrens 96', released in 1996, is a new variety that fits these requirements quite nicely. It is an improved version of the popular 'Wrens Abruzzi' variety.

Soybean One of the problems with soybeans in conservation tillage is that they are very sensitive to day length and won't produce adequate yields if planted too early or too late. We are working with some new genotypes that could give growers some flexibility in planting their crop. We believe that producers could plant these soybean over a 90- to 100-d period from 1 April to early July and still maintain good yields.

Southern growers now have a much narrower window for planting their crop - only 35 to 40 d from about 10 May to mid-June in the north Florida area. If farmers try to plant outside that narrow window, yields decrease because normal flowering is disrupted and seed production declines.

When the days are long, the soybean plant channels its energy into making leaves, stalks, and other vegetative growth. When the days shorten, the plant detects the reduction in sunlight and begins its reproductive period, producing flowers, pods, and seed.

Juvenile-types. These new genotypes are referred to as 'long-juvenile type' - meaning that the plants remain in their juvenile, vegetative growth stage for a longer time. Then, at a fixed time after planting, the plant leaves its juvenile stage, beginning its reproductive period and producing seed. The idea behind developing these juvenile soybean lines was to offer growers a variety that allowed the maximum flexibility for widening the planting window, while still maintaining good yields, and resistance to insect pests, nematodes, and diseases.

Some new genotypes that we are presently testing can be planted from mid-April to mid-July and will still yield competitively with popularly grown soybean varieties planted during the recommended planting window in North Florida. In Table 2, yields of the juvenile soybean lines from the April planting date at both Quincy and Jay are comparable to the yields of many commonly grown varieties. Similarly, yields are also comparable among the juvenile soybeans and the standard varieties planted in May at the Jay location. However, when you compare the yields of the long juvenile soybean lines planted in July to those of the popular varieties, the juvenile soybean outproduce the standard varieties. This occurs because the juvenile gene delays the reproductive period of the soybean until the plant has made sufficient growth. At that time, the soybean plant will begin flowering, followed by pod development. Because of the juvenile gene, the plant has obtained some height and can therefore support more of a pod load. Standard varieties, when planted in July, will generally remain short and become reproductive relatively early, hence lower yields from a poor pod set. Many juvenile lines had yields in the 30+ bu/a range from the July planting. Notice that 'Vernal' also yielded well. Vernal was the first released variety of soybean (developed by the USDA-ARS at Stoneville, Mississippi) which utilized the long juvenile trait.

There is a degree of variability among the juvenile soybean lines for yield in early or late plantings as is illustrated in Table 2. Some juvenile soybean lines perform better when planted early, while others lines yield comparatively better from a later planting. Several of the juvenile lines yielded 35+ bu/a from the late planting, although yields were reduced overall from such a late planting date.

Juvenile-type maturity. The benefit of early or late soybean planting fits the time frame for many double cropping systems, especially in conservation tillage, where an early soybean harvest is readily followed by small grains in the fall of the year, and late planted soybeans would follow corn *(Zea mays* L.) or small grains harvested in spring. Maturity observations indicate that early planted juvenile soybeans will mature in September and early October, while the late planted juvenile soybeans would mature in late October and November.

Among the juvenile lines that have been tested in Florida, there is considerable variability in maturity and many of these lines can be categorized in maturity groupings from MG IV to IX. This would be important if you desire a shorter season or full season soybean. Likewise, the juvenile lines vary in their resistances to various pests and diseases. While emphasis has been primarily on yield, the need for good resistance to southern and peanut root-knot nematodes *(Meloidogyne* spp.), frogeye leafspot, stem canker, and phomopsis has not been neglected. Many current lies have good resistance to multiple pests and diseases, as well as excellent seed quality, a trait of great importance when harvest may not occur during optimal harvest conditions.

A short coming in the development of these juvenile soybean lines has been that the resistance to the broad spectrum herbicides has not been added. However, such resistance can be readily transferred and the availability of the long juvenile soybean with broad-spectrum herbicide resistance will be possible in the near future.

Table 1. Elite oat nursery grown at the three locations in Georgia and one location in Florida, 1995.

Entry	Grain yield (bu/a)					Test weight- 4 location avg	Average plant
	Plains	Calhoun	Griffin	Quincy	4 locationavg.	(lb/bu)	height (in)'
Chapman	112.7	43.2	100.5	50.0	76.6	31.1	34
Florida 502	108.3	29.1	75.6	45.5	64.6	33.3	35
ACS-Harrison	107.7	42.9	117.3	23.7	72.9	34.4	40
Citation	94.2	29.1	106.1	2.3	57.9	33.7	37
ACS-811	56.2	37.5	111.7	27.2	58.2	34.2	34
GA-Mitchell	53.4	43.5	101.7	27.0	56.4	32.3	32
Grand mean	108.1	39.1	108.1	20.1			
$LSD_{(P=0.05)}$	13.5	19.6	15.9	13.6			
C.V. (%)	7.7	24.9	9.1	41.7			

'Average of Plains, Calhoun, and Griffin locations
[2]0 = no disease, 9 = very severe disease.

Table 2. Yield comparisons of long juvenile soybean lines with popular varieties that are yield competitive with either an early or late planting date in North Florida, 1996.

		Yield (bu/a)			
		Quincy[1]		Jay[2]	
	Juvenile line/Variety	April	July	April	May
Early-planted competitive	F91-2420	65.5	24.3	42.9	44.4
	F95-1935	64.5	23.7	----	----
	F94-1054	63.6	23.7	35.9	40.3
	F95-1299	61.3	14.3	----	----
	F95-1254	60.8	17.2	----	----
	F95-1765	60.7	32.9	----	----
	F94-2119	60.1	28.0	47.7	43.6
	F95-1119	56.4	28.3	----	----
Late planted competitive	F95-1774	59.7	36.4	49.1	29.0
	F95-1714	60.6	36.2	----	----
	F92-2127	42.0	35.9	40.3	37.4
	F94-1586	52.0	35.1	41.8	31.9
	F91-3597	57.7	32.9	53.5	38.5
	F91-1235	52.5	32.6	35.2	42.5
	F91-3076	52.9	32.5	39.6	47.7
	F94-1104	55.6	30.2	36.4	33.7
Standard varieties	Cook	63.2	25.3	58.7	51.3
	Doles	62.1	21.4	49.9	50.2
	DPL 105	61.9	18.0	----	----
	Haskell	60.3	13.9	44.4	49.1
	RA 452	60.2	9.6	----	----
	Davis	59.6	16.9	----	----
	Vernal	56.8	34.2	32.3	39.2
	Forrest	55.8	14.3	----	----
	Hutcheson	53.9	9.0	41.2	43.3

[1]Quincy location planted 26 Apr. 1996 and 17 July 1996, 3 replications.
[2]Jay location planted 24 Apr. and 31 May 1996, 3 replications. Conducted by H. A. Peacock