Densities and Herbicide Rates for No-Till Drilled Soybeans

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A field study was conducted at six locations in Illinois to evaluate the following objectives: 1) Compare adapted soybean varieties at three planting rates for days to canopy closure and evaluate weed control when no-till drilled into corn stubble; and 2) Evaluate the effects of 0.5x, *0.75x* and 1x of recommended herbicide rates for a total Pre-emergence (PRE) and a total Postemergence (POST) program, and a weedy check, on weed control and soybean yields. The locations included DeKalb and Monmouth in northern Illinois, Urbana and Perry in central Illinois, and Brownstown and Dixon Springs in southern Illinois. Urbana data is not included in this report.

At each location 3 adapted soybean varieties were combined with 3 planting densities designed to provide final plant stands of 140,000, 180,000 and 220,000 plants/acre. Varieties used at the northern and central locations included Pioneer brands 9273 (early) and 9342 (late) along with Asgrow 3237 (mid-season). Varieties at the two southern locations included Pioneer brands 9394 (early) and 9451 (mid) along with Asgrow 4715 (late).

Variety by planting rate combinations were randomized in strips and replicated 4 times. Across these 9 strips, 7 herbicide treatments were applied (in a strip-plot design or checkerboard pattern). The herbicide treatments included a check, 0.5 PRE, 0.75 PRE, 1.0 PRE, 0.5 Post, 0.75 Post and 1.0 Post. The 1.0 PRE consisted of 2 pints Dual II (2.5 pints were used in northern IL and Urbana) +7 oz Canopy. The entire plot area had been treated with 1 qt Roundup + 2,4-D + NIS and Ammonium Sulfate approximately 10 days before planting. The 1.0 POST treatment consisted of 0.25 oz Classic + 0.25 oz Pinnacle + 8 oz Assure II + 0.25% v/v NIS + 2.5% v/v UAN.

Weed seeds were sown just prior to planting at 4 out of the 5 locations in 1995 only (Perry was excluded). Weeds sown included common lambsquarters (Colq), redroot pigweed (Rrpw), giant foxtail (Gift) and velvetleaf (Vele). Data collected in 1995 include final soybean plant stands, grain yields, and days to canopy closure as well as weed counts and ratings (for each of the weeds above plus any significant residual weeds). In 1994, grain yields, plant stands, plant heights and weed control ratings were taken.

Plant Stands

Final plant stands varied by location and years, but in most cases were within a reasonable percentage of intended stands (Tables 1 and 2). Locations where stands were much lower than anticipated were usually affected by heavy rainfall in May and June especially immediately after planting. Because of the lateness of planting in both years, replanting seemed undesirable. There were occasionally location/years which showed varietal differences but they were small and tended to not affect final yields. Three out of five locations had stand losses associated with check treatments in 1995 but none in 1994, and only one out of five locations in 1995 only showed losses in stand with PRE treatments compared to POST treatments. These effects are probably due to increased competition from weeds in 1995. Overall, however, planting rates had much larger effects on final stand than did variety or herbicide treatments.

Canopy Closure

In 1994, there were observations of differences in canopy closure for the various treatments. In 1995, canopy closure was measured as the number of days from planting until a canopy was formed over the middles of the rows. Four out of five locations showed planting rate effects on days to canopy closure (Table 3). Planting rate differences varied due to differences in final stand but in general those locations with greater than 200,000 plants/acre canopied 3-7 days sooner than the lowest stands at the same location. Growing conditions and varieties also factored into canopy development. Check treatments canopied sooner at each location. In general, PRE herbicide treatments canopied 2-4 days earlier than POST and the 1.0 PRE rates delayed canopy closure by 1-2 days in southern Illinois. High rates of POST delayed canopy closure only at locations with poor stands due to weather problems.

Grain Yields

In 1994, the northern locations failed to produce significant increases in grain yield as planting rates increased (Tables 4 and 5). This may have been due to the higher stands than intended with the low rate or could be because of the growing conditions in 1994 (favorable weather and low weed competition). Four out of five locations increased yields with increasing seeding rates in 1995. Planting was delayed by wet weather in 1995 and late season development was reduced by high temperatures and low rainfall in August and September.

Table 1. Soybean plant stands (1000 pts/acre) at each location, 1994.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	159	179	135	--	84
180,000	181	175	190	--	104
220,000	202	208	239	--	125
Dense lin	**	**	**	--	**
Dense quad	*NS*	*	*NS*	--	*NS*
Variety					
Early	179	156	162 b	--	101
Mid-season	174	187	193 a	--	111
Late	191	190	205 a	--	101
LSD	NS	*NS*	*17.1*	--	*NS*
Herbicide					
Check	176	194	200	--	111
0.50 PRE	180	184	184	--	102
0.75 PRE	182	184	195	--	95
1.00 PRE	178	190	187	--	101
0.50 POST	181	185	192	--	99
0.75 POST	189	187	184	--	108
1.00 POST	183	187	177	--	114
Contrasts					
Ck vs others	*NS*	*NS*	*NS*	--	*NS*
PRE vs POST	*NS*	*NS*	*NS*	--	*NS*
PRE lin	*NS*	*NS*	*NS*	--	*NS*
POST lin	*NS*	*NS*	*10%*	--	*NS*
Var X Dense	*NS*	--	*NS*	--	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Earlier canopy development under the high planting rate may have conserved soil moisture which led to higher yields. Variety differences were not significant at any location in 1995 but were in 1994. Lateness of planting may have contributed to poorer variety performance in 1995. The check treatments had the lowest yields at four out of five locations in 1995 and three out of five in 1994. When average across all five locations in 1995, the checks yielded about 10 bu/acre less than the herbicide treated plots. Differences were less in 1994 because of lower weed pressure. The POST treatment yielded lower than the PRE at two locations, but higher at two other locations in 1995 and higher at one location only in 1994. Averaged acrossall locations, PRE and POST yielded about the same. At Dixon Springs there was a lower yield associated with cutting PRE herbicide rates in both years. This may be related to the tougher weed problems at Dixon Springs, as will be discussed below. At DeKalb, there was a significant yield reduction with the high rates of POST in 1995.

Weed Control

a) Gift. There was a dense stand of Gift at each of the five locations in both years. Soybean planting rate increased Gift control at three out of the five locations in 1995 but only one in 1994, however differences were very slight (Tables 6

Table 2. Soybean plant stands (1000 pts/acre) at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	101	143	125	141	156
180,000	114	182	157	143	177
220,000	120	203	166	148	223
Dense lin	**	**	**	*NS*	**
Dense quad	*NS*	*NS*	*NS*	*NS*	*NS*
Variety					
Early	111	164 b	150	145	182 b
Mid-season	111	198 a	151	145	167 b
Late	113	163 b	146	142	207 a
LSD	NS	*13.7*	*NS*	*NS*	*21.4*
Herbicide					
Check	105	169	145	125	136
0.50 PRE	114	178	149	153	200
0.75 PRE	110	161	157	158	178
1.00 PRE	115	172	149	141	191
0.50 POST	109	182	143	140	199
0.75 POST	118	183	159	144	208
1.00 POST	109	183	142	148	186
Contrasts					
Ck vs others	*10%*	*NS* *	*NS*	*	**
PRE vs POST	*NS*		*NS*	*NS*	*NS*
PRE lin	*NS*	*NS*	*NS*	*NS*	*NS*
POST lin	*NS*	*NS*	*NS*	*NS*	*NS*
Var X Dense	*NS*	*NS*	*NS*	*NS*	NS

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

and 7). Variety had little impact on Gift control. POST treatments did better than PRE at most location/years. There was a linear response with PRE rates at four out of five locations in 1995 but only at DeKalb in 1994. The 0.5 PRE rate provided 5-20% less control than the full PRE rate. The 0.5 POST rate was as good as any other herbicide treatment, indicating that for Gift under these conditions, we may be able to reduce POST rates.

b) Amaranthaceae (Amar). (Waterhemp was reported at the Brownstown location in 1995, all others reported redroot pigweed, Rrpw). These weeds were dense at each of the locations seeded in 1995. but few were found in 1994. Soybean planting rate and variety had little effect on Amar control (Table 8). The 0.5 POST and 0.5 PRE both worked as well as any other treatment. PRE equaled POST at every location.

c) Ilmg lvyleaf morning glories (Ilmg) were found at three of the locations in 1995 only. PRE and POST treatments did about equal at all locations but none controlled much more than about 80% of the Ilmg. Soybean planting rate and varieties had little effect. Other weeds were found at some of the locations, but stands were sparse and the data will not be included in this report.

Table 3. Days from planting to canopy closure at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	43	49	37	27	50
180,000	41	48	31	28	47
220,000	41	46	31	27	45
Dense lin	**	**	--	*NS*	**
Dense quad	*NS*	*NS*	--	*NS*	*NS*
Variety					
Early	42	49 a	--	27	47 b
Mid-season	41	47 b	--	27	47 b
Late	42	48 ab	--	28	49 a
LSD	*NS*	*1.4*	--	*NS*	*1.5*
Herbicide					
Check	39	44	--	26	42
0.50 PRE	40	47	--	26	45
0.75 PRE	40	47	--	27	48
1.00 PRE	40	47	--	27	51
0.50 POST	42	50	--	27	49
0.75 POST	43	51	--	27	49
1.00 POST	45	50	--	32	50
Contrasts					
Ck vs others	**	**	--	**	**
PRE vs POST	**	**	--	**	*NS*
PRE lin	*NS*	*NS*	--	*NS*	**
POST lin	**	*NS*	--	**	*NS*
Var X Dense	*NS*	*NS*	--	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Summary

Drilling adapted soybean varieties at a seeding rate to deliver final stands between 180,000 and 220,000 should provide for maximum yields and the quickest canopy closure. In our study, density effects on canopy closure helped in weed control, but differences in canopy closure of 3-7 days sooner for the high plant densities, were small compared to the effects of PRE and POST herbicides. At nearly every location, PRE and POST herbicide applications, even reduced rates, provided significantly better weed control than where no herbicides were applied. This accounted for a 10 bushel increase in soybean yields when averaged across the five locations. With $7/bushel soybean prices, this is more than economical compared *to* the cost of herbicides. For most of the weeds in these plots in 1994 and 1995, the 0.5 POST treatment provided as good of weed control as any other treatment. Many times however, the 0.5 PRE treatment faired worse than the 1.0 PRE treatment. There is an indication that if the farmer has a good knowledge of weeds in his fields, he may be able to use lower herbicide rates with no-till drilled soybean.

Table 4. Soybean grain yields bu/acre) at each location, 1994.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	45	51	40	30	44
180,000	45	50	42	36	48
220,000	45	51	44	35	47
Dense lin	*NS*	*NS*	**	*NS*	*
Dense quad	*NS*	*NS*	*NS*	*NS*	*10%*
Variety					
Early	46 a	50	43 a	32b	48 a
Mid-season	42 b	52	43 a	30b	45 b
Late		50	39 b	39 a	46 ab
LSD	*2.5*	*NS*	*I.6*	*5.6*	*2.8*
Herbicide					
Check	39	38	39	28	42
0.50 PRE	45	51	40	32	47
0.75 PRE	46	50	42	32	43
1.00 PRE	45	53	41	37	44
0.50 POST	39	55	42	37	49
0.75 POST	50	52	49	35	48
1.00 POST	50	54	40	36	48
contrasts					
Ck vs others	*NS*	**	*NS*	*	*10%*
PRE vs POST	*NS*	*NS*	*NS*	*NS*	*
PRE lin	*NS*	*NS*	*NS*	*NS*	*NS*
POST lin	*10%*	*NS*	*NS*	*NS*	*NS*
Var X Dense	*NS*	*10%*	*NS*	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Table 5. Soybean grain yields (bu/acre) at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	38.2	39.7	42.7	24.2	35.3
180,000	41.0	41.9	46.8	24.3	37.5
220,000	39.9		48.8	24.6	37.4
Dense lin	*10%*	**	**	*NS*	*10%*
Dense quad	*	*10%*	*NS*	*NS*	*NS*
Variety					
Early	39.2	40.8	45.6	25.2	36.4
Mid-season	40.2	42.2	47.0	25.3	37.0
Late		40.9	45.7	22.6	36.7
LSD	*NS*	*NS*	*NS*	*NS*	*NS*
Herbicide					
Check	36.1	33.4	41.2	22.4	21.2
0.50 PRE	40.8	43.9	46.6	29.1	33.2
0.75 PRE	41.6	44.4	46.6	25.6	36.1
1.00 PRE	42.5	43.3	44.6	23.0	38.9
0.50 POST	40.3	41.7	45.1	22.0	42.6
0.75 POST	39.1	41.1	47.5	24.5	42.5
1.00 POST	37.5	41.4	46.8	23.7	42.6
Contrasts					
Ck *vs others*	**	**	**	*NS*	*NS*
PRE vs POST	**	*	*NS*	*10%*	**
PRE lin	*NS*	*NS*	*NS*	*	**
POST lin	*	*NS*	*NS*	*NS*	
Var X Dense	*NS*	**	*NS*	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Table 6. Giant foxtail (Gift) control at each location, 1994.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	66	93	86	--	92
180,000	69	89	86	--	93
220,000	72	89	92	--	92
Dense lin	*NS*	*NS*	*	--	*NS*
Dense quad	*NS*	*NS*	*NS*	--	*NS*
Variety					
Early	--	--	--	--	93
Mid-season	--	--	--	--	93
Late	--	--	--	--	92
LSD	--	--	--	--	*NS*
Herbicide					
Check	0	0	0	--	0
0.50 PRE	63	92	90	--	95
0.75 PRE	79	81	95	--	94
1.00 PRE	82	95	95	--	97
0.50 POST	85	99	99	--	100
0.75 POST	86	96	100	--	100
1.00 POST	88	99	98	--	100
Contrasts					
Ck vs others	**	**	**	--	**
PRE vs POST	**	*10%*	*NS*	--	***10%***
*PRE **lin***	**	*NS*	*NS*	--	*NS*
*POST **lin***	*NS*	*NS*	***NS***	--	*NS*
Var X Dense	--	--	***NS***	--	NS

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Table 7. Giant foxtail (Gift) control at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	84	85.0	82	73	71
180,000	86	85.3	84	75	74
220,000	87	85.4	85	74	76
Dense lin	*	**	*NS*	*NS*	**
Dense quad	*NS*	*NS*	*NS*	*10%*	*NS*
Variety					
Early	87	85.2 ab	85	74	74 a
Mid-season	85	85.4 a	83	74	76 a
Late	87	85.1 b	83	74	71 b
LSD	*NS*	*0.24*	*NS*	*NS*	*2.1*
Herbicide					
Check	0	0	0	0	0
0.50 PRE	92	99	*85*	70	64
0.75 PRE	94	99	95	82	66
1.00 PRE	97	99	96	84	86
0.50 POST	99	100	99	94	99
0.75 POST	98	100	90	94	100
1.00 POST	99	100	100	93	99
Contrasts					
Ck vs others	**	**	**	**	**
PRE vs POST	**	**	*	**	**
PRE lin	*	*NS*	*10%*	**	**
POST lin	*NS*	*NS*	*NS*	*NS*	*NS*
Var X Dense	*NS*	*NS*	*NS*	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Table 8. Amaranthaceae (Pigweed family) control at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	86	86	--	79	86
180,000	85	86	--	80	86
220,000	87	86	--	80	86
Dense lin	*	*NS*	--	*NS*	*NS*
Dense quad	*10%*	*NS*	--	*NS*	*NS*
Variety					
Early	86	86	--	80	86
Mid-season	87	86	--	79	86
Late	86	86	--	79	86
LSD	NS	*NS*	--	*NS*	*NS*
Herbicide					
Check	0	0	--	0	0
0.50 PRE	99	100	--	84	100
0.75 PRE	99	100	--	95	100
1.00 PRE	99	100	--	96	100
0.50 POST	99	100	--	93	100
0.75 POST	99	100	--	93	100
1.00 POST	99	100	--	95	100
Contrasts					
Ck vs others	**	**	--	**	**
PRE vs POST	*NS*	*NS*	--	*NS*	*NS*
PRE lin	*NS*	*NS*	--	*10%*	*NS*
POST lin	*NS*	*NS*	--	*NS*	*NS*
Var X Dense	*NS*	*NS*	--	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not significant.

Table 9. Morningglory (Ilmg) control at each location, 1995.

Variable	DeKalb	Monmouth	Perry	Brownstown	Dixon Springs
Planting Rate					
140,000	--	69	--	72	62
180,000	--	70	--	73	67
220,000	--	73	--	72	66
Dense lin	--	*10%*	--	*NS*	*10%*
Dense quad	--	*NS*	--	*NS*	*NS*
Variety					
Early	--	69	--	74	62 b
Mid-season	--	73	--	72	64 ab
Late	--	70	--	71	69 a
LSD	--	*NS*	--	*NS*	*5.4*
Herbicide					
Check	--	0	--	0	0
0.50 PRE	--	83	--	81	71
0.75 PRE	--	88	--	82	75
1.00 PRE	--	82	--	85	88
0.50 POST		74	--	85	71
0.75 POST	--	80	--	87	74
1.00 POST	--	80	--	87	75
Contrasts					
Ck vs others	--	**	--	**	**
PRE vs POST	--	*NS*	--	*10%*	*NS*
PRE lin	--	*NS*	--	*NS*	*NS*
POST lin	--	*NS*	--	*NS*	*NS*
VarX Dense	--	*NS*	--	*NS*	*NS*

10%, * and ** refer to 10%, 5% and 1% levels of significance. NS = not Significant.