Sugar Beet Planter Tests In Imperial Valley, Calif., Fall, 1945

G. W. Howard[1]

Purposes of Imperial Valley tests (November 20-December 20, 1945) were to do some work along the following lines:

1. Standardize type of seed.
2. Test planters at different rates of seeding and different speeds.
3. Attempt to make mechanical recommendations based upon stands that developed.

Nine drills were tested:

1. John Deere No. 55.
   a. Long curved smooth tube.
   b. Short straight smooth tube.
2. John Deere low can—forerunner of Model No. 66 drill.
3. I. H. C. conversion to smooth tube from No. 40 with telescoped smooth tubes.
4. I. H. C. No. 46 low can drill.
5. Cobbley (Not the Plant-trol unit)
6. Rassmann
7. Aircraft Mechanics
8. Olson
9. Ford Ferguson

The following drills have been considered as commercial drills:
John Deere No. 55
I. H. C. No. 40
Cobbley
Rassmann

The balance should be considered as experimental drills.

We had planned to include the Case drill with their latest improved plates but were unable to do so because this equipment arrived in Brawley too late for any work to be done with it. We are, however,

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carrying on experiments at the present time in cooperation with the U. S. Department of Agriculture and Colorado A & M College at Fort Collins. These late tests show that with use of a special machined filler plate and a cell plate built especially for segmented seed, the grinding of the Case planters is practically negligible.

Greased board tests were in general made at *2,* 3, *4V2,* and 0 miles per hour and at seeding rales of as close to *2,* 4, 6, 8, and 10 seeds per foot as practicable.

Three replicated samples of seed from '200 feet of row were taken off the test rack alternately between each 100 inches of greased board. These samples were sent, to the laboratories for comparison with original seed samples to determine seed damage. One of these samples was sent In J. A. Hair of the Great Western Sugar Company at Fort Collins. The seed was actually counted after having been run over a 6/(i4 screen. This figure was used to determine cell fill in our various drill tests. The other two samples were sent to C. E. Cormany of Holly Sugar Corporation at Sheridan for replicated germination tests.

Field plantings were made one row at a time at 3 miles per hour only. In the drill comparisons three replicated plots of each test

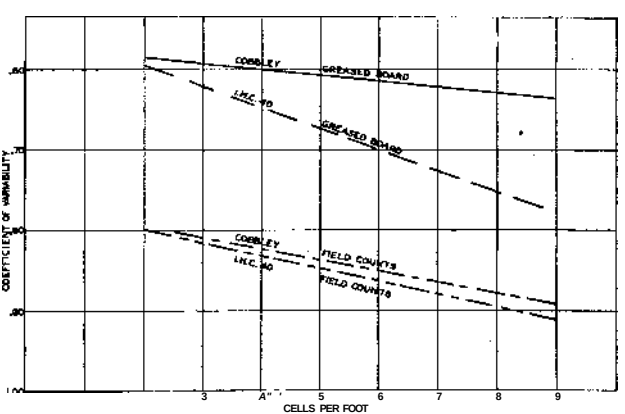

Figure 1.—Loss of paltcrn, givased bo:iril, :t m.p.li., field.

were made. Prom each of these plots twenty 100-inch counts were made in the following manner; the first count started at 15 feet from the end of the plot and 5 feet was allowed between each 100-inch count. From these assembled data we are making the following calculations:

TOTAL BEET-CONTAINING INCHES

Single plants
Double plants
Three or more
Longest gap
Total plants in 100 inches

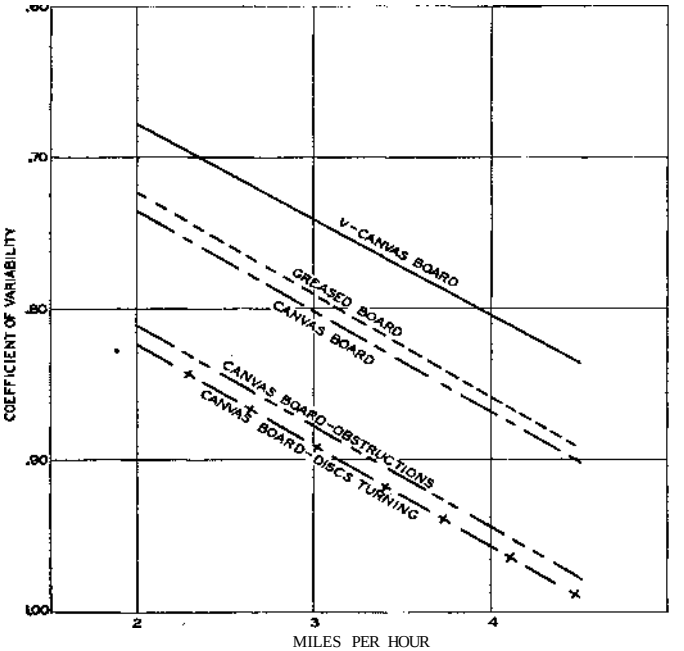

Figure 2.—Study of seod roll from forward drill motion.

We have also used these data to compare, in a limited way, the greased board data from the same drill. (Table 1).

We attempted to take as thorough and dependable data as possible and were unbiased in our operations. All those who worked on the Brawley tests had in mind that we were after drill and planting information in general and were not out to give any certain party a boost nor to bring discredit to any drill or organization.

Those who worked on the tests for the Beet Sugar Development Foundation, directly under P. B. Smith, were: S. W. McBirney, U. S. Department of Agriculture, A. J. Bigler, Utah-Idaho Sugar Company ; Norman Lawlor, American Crystal Sugar Company; W. E. Walters, Great Western Sugar Company; E. P. Pattison, Holly Sugar Corporation; Chris Lohry, Great Western Sugar Company; and G. W. Howard, Beet Sugar Development Foundation.

We received fine cooperation from all implement people and especially from the following persons: Ti. C. Brown, agricultural

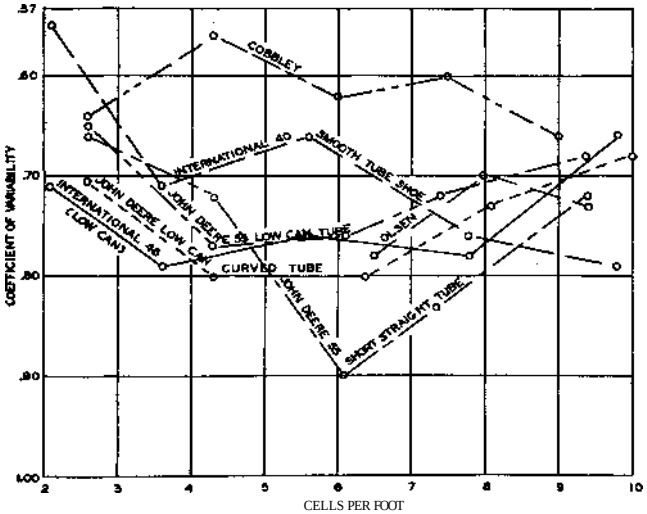

Figure 3.—Pattern comparisons, various drills, 3 in.p.h., greased board.

superintendeni, Holly Sugar Corporation, Brawley, Calif.; Robert Barr, field man, Holly Sugar Corporation, El Centro, Calif. ; H. V. Hansen, planter engineer, and George Cole of the Research staff, both of Ford-Ferguson Company; Hugo R-assmann, designer, of Diamond Iron Works; G. II. Kriegbaum, chief engineer, International Harvester Company; V. F. Bozeman, general manager, John Deere Wagon Works; Proctor Nichols, president, Aircraft Mechanics; E. F. Kratz, sales manager, J. I. Case Company; Harold J. Agee, manager, Olson Manufacturing Company; Roy Bainer, agricultural engineer, University of California; C. E. Cormany, research manager, Holly Sugar Corporatino; A. A. Schupp and Phelps Vogelsang, of Farmers and Manufacturers Beet Sugar Association; J. A. Bair, chief chemist, Great Western Sugar Company; Ralph Partridge, factory manager. Great "Western Sugar Company, Fort Collins, Colo. ; E. M. Mervine, agricultural engineer, Colorado A & M College; -John Edmiston, factory manager, Great Western Sugar Company, Windsor, Colo. ; Roy Marsh, fieldman, Great Western Sugar Company, Windsor*, Colo.

Judging from Brawley data several points seem evident:

(1) There is no perfect beet drill to date.

(2) The greased board and electronics tester are questionable methods of testing overall drills. We did not attempt to test metering devices alone, but to test each drill as it would actually go into the field.

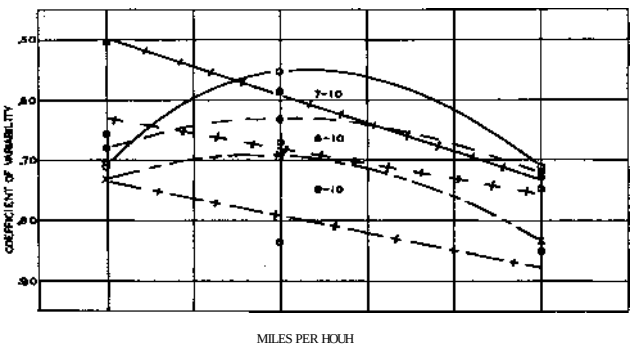

Figure 4.—Pattern *and* cell fill, Rassman, various seed sizes, 11/64 plates.

(3) A good formula for evaluating both pattern on the greased board and field germination stands should be developed. "We have used in our tests Roland Cannon's "Coefficient of Variability'' procedure because it evaluates pattern by a relatively short method. By choosing this method, wo do not wish to discredit any other evaluation procedure. Tt does not, however, consider cell fill nor grinding of seed. These two variables will be hard to include in a pattern evaluating method.

(4) We are convinced that it is necessary to do considerable more work in getting the perfect beet seed which might include seed processing as well as seed breeding. Table 1 shows pattern comparisons with seed, used in the Imperial Valley tests.

(5) Improvements in emergence should be studied.

A considerable loss of pattern occurs between the greased board and the field. (Figure 1). Results from two common drills have been compared to show a difference of 15 to 25 percent loss. Some of this loss is a result of improper germination and some can be attributed to difference in cell fill, but a good portion, we believe, is due to the difference in forward roll of the beet seed after it leaves the moving drill. No drills on the market today take into account the forward motion of the drill in distributing the seed. This fact cannot be overlooked in explaining the difference between greased board results and actual field plantings. To try to pin this roll value down we have just completed some tests at Windsor. (Figure 2). These results did not turn out exactly as expected but are nevertheless somewhat revealing.

The besl value in coefficient of variability was obtained by stitching a 12 inch piece of 8 ounce dam canvas in the center and bonding the two edges outward, nailing them on the 6 inch board. This "V"

Figure 5.—Cellfill at 3 m.p.h.

Table 1.--Pattern comparisons greased board, Imperial Valley planter tests. Miles per hour Seeding rate 2.1 cells per foot.

	2 m.p.h.		3 m.p.h.		4.5 m.p.h.		6 m.p.h.	
Planter	Rate	Coef. of variability	Rate Seeds per foot	Coef. of variability	Rate Seeds per foot	Coef. of variability	Rate Seeds per foot	Coef. of variability
Cobbley			2.6	.64	2.6	.66	2.6	.92
Cobbley			4.35	.56	4.3	.58	4.3	.72
Cobbley			6.00	.62	8.0	.63	6.0	.72
Cobbley			7.5	.60	7.5	.68	7.4	.66
Cobbley			9.0	.68	9.0	.70	9.0	.76
I.H.C. No. 40—shoe	2.1	.61	2.1	.55	2.1	.57		
I.H.C. No. 40—shoe	3.6	.57	3.0	.71	3.6	.68		
I.H.C. No. 40—shue	5.6	.64	5.6	.66	5.6	.92		
I.H.C. No. 40—shoe	7.8	.70	7.8	.76	7.8	.87		
I.H.C. No. 40—shoe	9.8	.77	9.8	.78	9.8	.78		
J.D. low can, curved tube			2.6	.71	2.6	.69	2.56	.79
J.D. low can, curved tube			4.3	.80	4.29	.78	4.29	.99
J.D. low can, curved tube			6.42	.80	6.42	.87	6.42	.86
J.D. low can, curved tube			8.1	.73	8.1	.87	8.1	.83
J.D. low can, curved tube			10.0	.68	10.0	.85	10.0	.89
J.D. No. 55, McBirney tube			2.6	.66	2.6	.75	2.6	.77
J.D. No. 55, McBirney tube			4.3	.73	4.3	.81	4.3	.98
J.D. No. 55, McBirney tube			6.1	.90	6.1	.84	6.1	.88
J.D. No. 55, McBirney tube			7.4	.83	7.4	.87	7.4	.71
J.D. No. 55, McBirney tube			9.4	.72	9.4	.92	9.4	.90
I.H.C. No. 46 low can	2.1	.64	2.1	.71	2.1	.75		
I.H.C. No 46 low can	3.6	.71	3.6	.79	3.6	.82		
I.H.C. No. 46 low can	5.6	.74	5.6	.76	5.6	.74		
I.H.C. No. 46 low can	7.8	.71	7.8	.78	7.8	.70		
I.H.C. No. 46 low can	9.8	.74	9.8	.66	9.8	.90		
Olson	0.5	.75	0.5	.78	0.5	.65		
Olson	8.0	.60	8.0	.70	8.0	.78		
Olson	9.4	.70	9.4	.78	9.4	.74		
Rasmann 7/10	8.0	.71	8.1	.55	8.1	.71		
Rasmann 8/10	8.1	.68	8.1	.63	8.1	.72		
Rasmann 9/10	8.0	.73	8.1	.69	8.1	.83		
J.D. No. 55 low curved tube			2.6	.65	2.6	.67	2.6	.75
J.D. No. 55 low curved tube			4.3	.77	4.3	.74	4.3	.81
J.D. No. 55 low curved tube			6.1	.76	6.1	.84	6.1	.81
J.D. No. 55 low curved tube			9.4	.68	9.4	.85	9.4	.95
J.D. No. 55 low curved tube			7.4	.72	7.4	.81	7.4	.77
I.H.C. No. 40 spiral tube	2.1	.91	2.1	.81	2.1	.71		
Aircraft Mechanics	12.0	.70	12.0	.69	12.0	.81		

canvas immediately wedged the seed as it came out of the seed tube and apparently eliminated any roll or distortion whatsoever. Another canvas board was then tried which had a round bottom allowing the seed to roll. The coefficient of variability of this board and the greased hoard came out practically the same but about 8 percent worse than the "V" canvas, indicating that if the seed roll was

present it was all approximately equal when no obstructions were present. We then ran the latter board under two other conditions, first with interference particles spaced along the board and second, with the discs actually turning on the board. These two boards gave patterns almost identical but about 10 percent less favorable than the

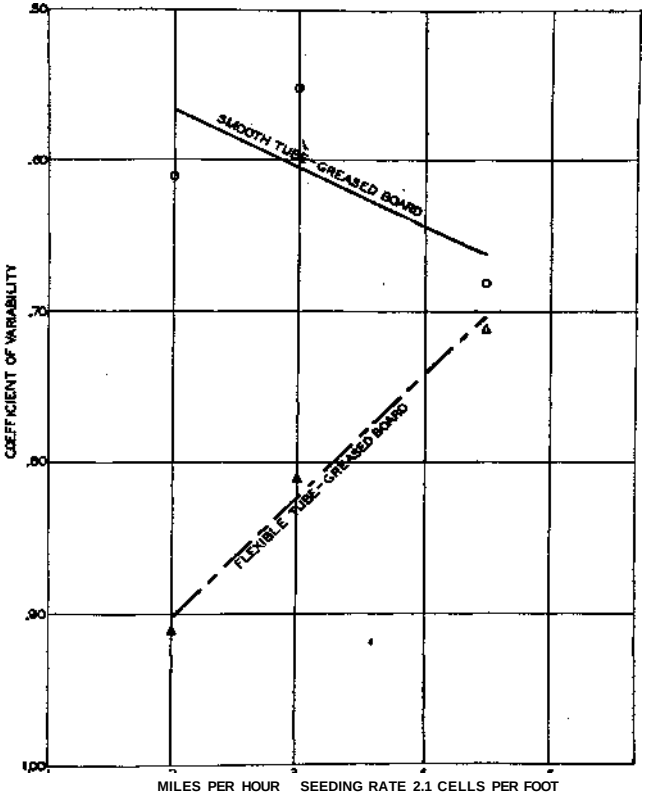

Figure G.—Flexible tube—smooth tube comparisons, I. H. C. No. 40.

Table 2.—Comparison of various planters at 2 miles per hour (grease board test), Brawley, Calif., test.

Planter	Actual pounds of 7/9 seed used per acre*	Theoretical cells per foot row	Percent actual cell fill	Actual number of sprouts per 100 feet of row**	Total potential sprouts per 100 feet of row	Seed pieces larger than 6/64 remaining per 100 feet of row	Total sprouts per 100 feet of row after passing metering device	Sprouts lost per 100 feet of row		Total sprouts per 100 feet of row after passing metering device; as percentage of theoretical seeding
								No.	Percent	
I.H.C. No. 40	1.40	2.1	149	313	307	293	261	46	15	124
	2.82	3.6	145	522	572	484	421	91	18	117
	3.38	5.6	135	755	740	703	563	157	21	101
	5.18	7.8	148	1,156	1,133	1,055	831	302	27	107
	6.29	9.8	143	1,401	1,373	1,297	1,051	322	23	107
I.H.C. No. 46	1.76	2.1	187	302	384	309	239	45	12	161
	3.98	5.6	159	893	875	842	775	100	11	138
	4.83	7.8	138	1,075	1,054	1,012	911	143	14	117
	5.81	9.8	132	1,289	1,263	1,219	1,134	129	10	116
Olson	1.94	2.5	67	437	428	411	345	83	19	53
	2.93	3.0	82	654	641	617	543	98	15	68
	2.77	9.4	66	621	609	601	421	188	31	45
Rassmann 7/10		3.1	145	1,174	1,151	1,127	992			122
*** 8/10		3.1	113	917	899	889	747			92
9/10		3.1	101	815	799	804	852			105
Aircraft Mechanics	5.80	12.0	111	1,336		1,067	768			64

*Percent cell fill considered in computations.

**Based on average of three tests of 200 feet each.

***Only 11/64 plates available.

greased board and plain round bottom canvas board. These tests are preliminary but we believe they point towards a method o£ evaluating seed roll.

If we establish 1hat the forward seed roll is harmful to field seed distribution we need a standard of measuring pattern to test overall drills. Our thinking has gone as far as to design a pilot experimental seed metering device which will induce backward rotor speed equal to the forward drill motion allowing seed to drop in a dead fall without forward or backward motion. We expect trouble with cell fill and knockout with this new design but we have taken steps to solve 1hese problems. With this experimental model we plan to do some work in the canvas board and on the greased board. If our results are somewhat equal we believe we will have accomplished something important in the testing of the drill as it goes into the field.

Tn comparing pattern values (Figure 3) from the greased board we note that the Cobbley is higher than the other drills. A similarity of the John Deere long curved tube and the John Deere low can lines

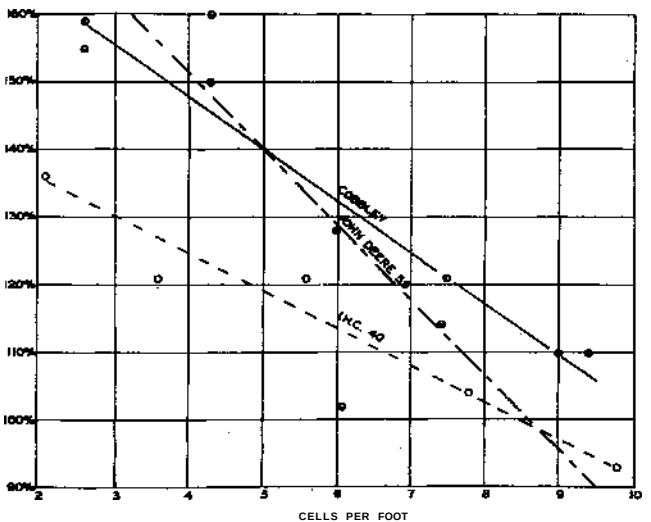

Table 3.—Comparison of various planters at 3 miles per hour (grease board and field tests), Brawley, Calif., test.

Planter	Actual pounds of 7/0 seed used per acre*	Theoretical cells per foot row	Percent actual cell fill	Actual number of seeds per 100 feet of row**	Total potential sprouts per 100 feet of row	Shed pieces larger than 6/64 remaining per 100 feet of row	Total sprouts per 100 feet of row after passing metering device	Sprouts lost per 100 feet of row		Total sprouts per 100 feet of row after passing metering device as percentage of theoretical seeding	Total plants emerging Per 100 feet of row in field***	Percent emergence in field	Percent of single beet containing inches
								No.	Percent				
I.H.C. No. 40	1.47	2.1	156	327	320	304	253	65	20	121	189	90	84
	2.19	3.6	137	494	484	455	382	102	21	106	324	90	90
	3.28	5.6	131	732	717	681	581	186	26	95	476	82	79
	4.69	7.8	134	1045	1024	975	780	244	24	100	616	76	74
	5.85	9.8	133	1305	1279	1222	831	448	35	85	727	72	68
I.H.C. No. 46	1.63	2.1	173	364	357	344	298	58	16	142	252	120	85
	2.67	3.6	167	600	588	561	492	106	18	134	385	107	80
	4.05	5.6	162	905	887	856	710	177	20	127	515	92	77
	4.59	7.8	131	1019	996	958	843	133	13	108	656	81	71
	5.02	9.8	114	1121	1099	1067	736	363	33	75	727	72	67
J. D. Low Can (curved tube)	2.28	2.56	190	487	477	460	368	91	19	151	302	116	85
	3.42	4.3	180	777	761	721	634	127	17	147	451	105	79
	4.12	6.4	142	908	890	856	685	205	23	107	640	100	73
	4.93	8.1	137	1111	1089	1054	780	309	28	96	779	95	68
	6.21	10.0	138	1377	1349	1305	940	409	30	94	809	87	65
J. D. No. 55 (long curved tube)	2.00	2.6	167	434	425	405	369	56	13	142	318	138	86
	3.14	4.3	165	708	694	668	588	106	15	137	511	105	90
	4.40	6.1	163	992	972	939	808	164	17	132	573	97	73
	4.95	7.4	150	1108	1086	1048	858	248	23	113	670	90	72
	5.75	9.4	137	1285	1259	1219	890	369	29	95	864	92	65

Table 3.—Continued.

Cobbley		1.88	2.6	157	408	400	362	297	103	26	114	193	88	84
		3.15	4.3	160	713	699	642	514	185	26	120	278	76	64
		4.10	6.0	152	914	898	818	679	217	24	113	462	74	70
		5.03	7.5	148	1107	1085	994	815	270	25	114	538	70	76
		5.64	9.0	141	1272	1247	1153	842	405	32	94	675	72	73
Olson		1.80	6.5	64	410*	411	364	306	105	26	47	175	27	88
		2.12	8.0	59	471	462	406	357	105	23	45	185	23	86
		1.72	9.4	41	387	379	353	247	132	35	26	731	14	89
Rassmann	7/10		8.1	127	1028	1007	927	803			100	616	82	69
****	8/10		8.1	108	878	858	856	907			112			
	9/10		8.1	75	608	596	597	669			83			
Aircraft Mechanic		5.89	12.0	100	1305		1060	670			56	812	26	82

*Percent cell fill considered in computation.

**Based on average of three tests of 200 feet each.

***Based on average of 60 field counts of 100 inches each.

****Only 11/64 plates available.

Table 4.—Comparison of various planters at 4½ miles per hour (grease board test), Brawley, Calif., test.

Planter	Actual pounds of 7/9 seed used per acre*	Theoretical cells per foot row	Percent actual cell fill	Actual number of sprouts per 100 feet of row**	Total potential sprouts per 100 feet of row	Seed pieces larger than 6/64 remaining per 100 feet of row	Total sprouts per 100 feet of row after passing metering device	Sprouts lost per 100 feet of row		Total sprouts per 100 feet of row after passing metering device; as percentage of theoretical seeding
								No.	Percent	
I.H.C. No. 40	1.35	2.1	144	303	297	285	230	68	20	114
	2.10	3.6	131	471	462	437	362	99	21	101
	3.23	5.6	129	726	711	677	528	183	25	94
	3.82	7.8	112	873	856	815	644	212	25	83
	4.35	9.8	93	975	958	913	630	326	34	65
I.H.C. No. 46	1.85	2.1	176	360	362	352	268	94	26	128
	2.53	3.6	158	568	557	534	427	150	28	119
	3.55	5.6	142	799	777	751	571	206	27	102
	3.92	7.8	112	873	856	828	620	227	27	81
	3.70	9.8	84	828	811	810	616	195	24	63
J. D. Low Can (curved tube)	2.11	2.8	176	457	448	452	346	102	23	133
	3.17	4.3	167	720	706	684	575	131	19	134
	4.06	6.4	140	893	875	843	666	209	24	104
	4.75	8.1	132	1,089	1,048	1,019	836	212	20	103
	4.86	10.0	108	1,075	1,054	1,029	772	282	27	77
J. D. No. 55 (long curved tube)	1.94	2.0	162	421	413	403	363	50	12	140
	3.17	4.3	167	718	704	687	598	106	15	139
	2.86	6.1	100	649	636	625	506	130	20	83
	4.03	7.4	122	901	883	868	720	163	18	97
	4.75	9.4	113	1,065	1,044	1,031	814	230	22	87

Table 4.—Continued.

Cobbley	2.09	2.6	174	452	443	414	330	104	28	130
	2.03	4.3	154	663	650	602	506	144	22	118
	3.92	6.0	145	872	855	780	646	209	24	108
	4.66	7.5	127	1,025	1,005	912	812	193	19	103
	4.96	9.0	124	1,120	1,098	995	816	282	26	91
Olson	2.61	6.5	90	682	570	442	371	198	35	57
	2.45	8.0	68	545	534	391	344	190	36	43
	1.55	9.4	37	350	343	247	173	170	50	18
Rassmann 7/10		8.1	101	817	801	771	668			82
*** 8/10		8.1	101	770	735	749	697			86
9/10		8.1	70	569	558	558	547			68
Aircraft Mechanic	3.67	12.	68	820		631	485			36

*Percent cell fill considered in computations.

**Based on average of three tests of 200 feet each.

***Only 11/04 plates available.

Table 5.—Comparison of various planters at 6 miles per hour (grease board test), Brawley, Calif., test.

Planter	Seed used per acre* Actual pounds at 7/0	Theoretical cells per foot row	Percent actual cell fill	Actual number of sprouts per 100 feet of row**	Total potential sprouts per 100 feet of row	Seed pieces larger than 6/64 remaining per 100 feet of row	Total sprouts per 100 feet of row after passing metering device	Sprouts lost per 100 feet of row		Total sprouts per 100 feet of row after passing metering device as percentage of theoretical seeding
								No.	Percent	
J. D. Low Can (curved tube)	2.32	2.6	193	502	492	417	367	125	25	141
	3.14	4.3	165	711	697	671	510	187	27	119
	3.38	6.4	116	742	727	707	544	183	25	85
	4.50	8.1	125	1,015	995	968	735	240	24	93
	2.97	10.0	66	662	649	635	419	230	35	42
J. D. No. 55 (long curved tube)	1.88	2.6	157	409	401	394	330	62	15	130
	2.70	4.3	142	610	598	587	487	111	19	113
	3.38	6.1	125	763	748	740	585	163	22	96
	3.73	7.4	113	834	817	810	664	153	19	90
	3.80	9.4	92	863	846	840	622	224	28	66
Cobbley	1.80	2.6	185	404	396	389	306	90	23	118
	2.76	4.3	145	624	612	595	503	100	18	117
	3.46	6.0	128	769	754	690	594	160	21	99
	4.25	7.5	125	935	916	843	730	166	18	100
	4.4	9.0	110	994	974	885	673	301	31	75

*Percent cell fill considered in computations.

**Based on average of three tests of 200 feet each.

***Only 11/64 plates available.

is noted. The John Deere Xo. 55 long curved tube seems to have a slight pattern advantage over the shorter straight tube.

A strange pattern evaluation eame from a study of the Rassmann planter using different sized seed in their 1.1/64 inch rotor. (Figure 4). Note that the pattern is better using 7-10 seed at high cell fill than when closer graded seed was used. We were somewhat surprised at this result.

A cell fill study was made (Figure 5) of several drills at 3 m.p.h. showing a John Deere average of around 150 percent, Cobbley 140 percent and I. H. C. No. 40 al 130 percent. In all of these there is a definite decrease at higher seeding rates.

It is an accepted fact that the smooth tube gives a better pattern than the flexible spiral tube (Figure 6) but we also made a comparison from our laboratory studies. The difference at 2 m.p.h. is shown as about 30 percent and at 3 m.p.h. reading values differ by about 25 percent. Due to the fact that these are laboratory differences the field differences will most surely be more because of air current interference with the flexible spiral tube.

A good study of seed damage was made using a fi/64th screen and calling the plusses undamaged seed and the minuses as the damaged units. Table 3 shows the Cobbley to be the worst offender in this category as compared with the various other commercial drills. The John Deere No. 55 can seems to be acceptable from this angle.

The laboratory germination data on seed used is shown in Table 6.

Table 6.—Imperial Valley seed comparison test :it 3 m.p.h.

Seed	Units per pound	Normal sprouts per viable seed ball	Sprouts per 100 seed balls	Percent singles	Percent emergence on potential
U. S. No. 22 7(1 Whole	60,«63	1.-12	88	70	66
U. S. No. 22 7 9 Segmented	60.28S	1.27	89	79	62
TT. S. No. 22 7-10 Segmented	56,592	1.39	113	09	50
U. S. No. 22 11-13 Pellets (from 7-9 segmented*	5.700	1.18	52	82	85

We are not prepared to make any statement condemning or appraising any particular drill but the facts disclose that there are apparent weaknesses in all of the drills which we tested and that further work needs to be done to develop improvements in their performance.