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Calibration Tables

For Power Sprayers

BY O. B. WOOTEN AND
J. T. HOLSTUN, JR.

Mississippi State University
AGRICULTURAL EXPERIMENT STATION

HENRY LEVECK, Director

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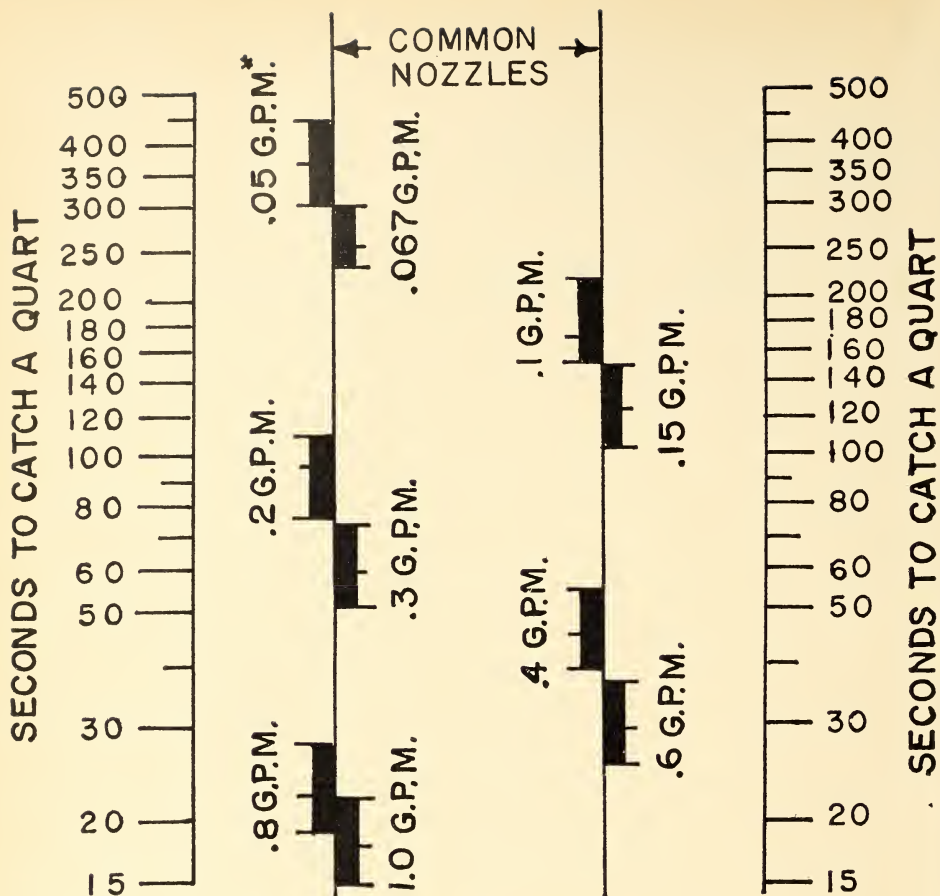


Figure 1.—Nozzle Selection Chart.

Manufacturers designate size of nozzles in different ways, but all of them provide flow data in gallons per minute (G.P.M.) at specified pressures. The above designations (ie., 0.05 to 1.0) are the rated deliveries in gallons per minute at 40 p.s.i. On each broad bar are 3 short lines. The top lines indicate the delivery at 20 p.s.i., the middle line at 30 p.s.i., and the bottom line at 40 p.s.i.

Example of Use: You need a nozzle which will deliver 1 quart in 100 seconds. Lay a straight edge from 100 sec./qt. on the left to 100 sec./qt. on the right. Intersection of the broad bar between the 20 and 30 p.s.i. lines of the 0.2 gal./min. nozzle indicated you will need a nozzle rated to deliver 0.2 gal./min. at 40 p.s.i., and that your spraying pressure should lie between 26 and 29 p.s.i.

CALIBRATION TABLES FOR POWER SPRAYERS

BY O. B. WOOTEN AND J. T. HOLSTUN, JR.¹

Safe, effective use of herbicides to control weeds in crop land demands accurate calibration of the application equipment. An underdose will not control the weeds; an overdose is wasteful. Even more important, an overdose may kill your crop and result in accumulation of toxic residues in the soil.

Accurate calibration can be fast and easy. The tables presented will cover most of the herbicide applications for power sprayers.

Calibrating knapsack sprayers and granular distributors, including calibration and mixing formulas will be published in a subsequent bulletin.

Calibration Procedure

Calibration of power sprayers involves selection of the right combination of nozzle type, nozzle orifice size, number of

nozzles, nozzle placement, spraying pressure, and sprayer speed for the rate of application desired.

There are many ways in which the right combination can be selected. A practical method is to:

1. Determine the rate of application to be used, and which type of nozzle is appropriate for the application, that is, wide or narrow spray angle, even distribution or regular distribution, etc.

¹Agricultural Engineer, Agricultural Engineering Research Division, and Agronomist, Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, respectively.

Cooperative investigation of Agricultural Engineering Research Division and Crops Research Division, Agricultural Research Service, U. S. Department of Agriculture, and Delta Branch, Mississippi Agricultural Experiment Station, Stoneville, and is a contribution to Regional Cotton Mechanization Project S-2.

Table 1. Number of seconds required for delivery of 1 quart from 1 nozzle when a sprayer at a specified speed is applying a specified volume per 13068 row feet of a band of any width from 1 nozzle per row.¹

Speed		Gallons/13068 row feet from 1 nozzle						
MPH	Seconds per 300 feet	6	10	12	14	16	18	20
2.2	93	169	101	84	72	63	56	51
2.4	85	155	93	77	66	58	52	46
2.6	79	143	86	71	61	54	48	43
2.8	73	133	80	66	57	50	44	40
3.0	68	124	74	62	53	46	41	37
3.2	64	116	70	58	50	44	39	35
3.4	60	109	66	55	47	41	36	33
3.6	57	103	62	52	44	39	34	31
3.8	54	98	59	49	42	37	33	29
4.0	51	93	56	46	40	35	31	28
4.2	49	88	53	44	38	33	29	26
4.4	46	84	51	42	36	32	28	25
4.6	44	81	48	40	35	30	27	24
4.8	43	77	46	39	33	29	26	23
5.0	41	74	45	37	32	28	25	22
5.2	39	71	43	36	31	27	24	21
5.4	38	69	41	34	30	26	23	21
5.6	37	66	40	33	28	25	22	20
5.8	35	64	38	32	27	24	21	19
6.0	34	62	37	31	26	23	21	19
7.0	29	53	32	26	23	20	18	16

¹Use primarily for calibration of band-type sprayers having 1 nozzle per row.

Table 3. Number of seconds required for delivery of 1 quart from one nozzle when

Nozzle spacing (inches)	Rate of applic. (Gal./A)	SPRAYER SPEED (MPH)								
		1.0	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4
40	5	446	223	202	186	172	159	149	139	131
	10	223	112	101	93	86	80	74	70	66
	15	148	74	67	62	57	53	49	46	44
	20	111	56	50	46	43	40	37	35	33
	25	89	45	40	37	34	32	30	28	26
	30	74	37	34	31	28	26	25	23	22
	35	64	32	29	27	25	23	21	20	
	40	56	28	25	23	22	20			
20	5	892	446	405	372	343	318	297	278	262
	10	446	223	202	186	172	159	149	139	131
	15	296	148	134	123	114	106	99	92	87
	20	222	111	101	93	85	79	74	69	65
	25	178	89	81	74	69	64	59	56	52
	30	148	74	67	62	57	53	49	46	44
	35	128	64	58	53	49	46	43	40	38
	40	112	56	51	47	43	40	37	35	33
10	5	1784	892	810	744	687	637	594	557	524
	10	892	446	405	372	343	318	297	278	262
	15	592	296	269	247	228	211	197	185	174
	20	444	222	202	185	171	159	148	139	131
	25	356	178	162	148	137	127	119	111	105
	30	296	148	134	123	114	106	99	92	87
	35	256	128	116	107	99	91	85	80	75
	40	224	112	102	93	86	80	75	70	66
38	5	469	235	213	196	181	167	156	146	138
	10	234	117	106	98	90	84	78	73	69
	15	156	78	71	65	60	56	52	49	46
	20	117	59	53	49	45	42	39	37	34
	25	94	47	43	39	36	34	31	29	29
	30	78	39	35	33	30	28	26	24	23
	35	67	34	30	28	26	24	22	21	20
	40	59	30	27	25	23	21	20		
19	5	938	469	426	391	361	335	312	293	276
	10	468	234	212	195	180	167	156	146	138
	15	312	156	142	130	120	111	104	97	92
	20	234	117	106	98	90	84	78	73	69
	25	188	94	85	78	72	67	63	59	55
	30	156	78	71	65	60	56	52	49	46
	35	134	67	61	56	52	48	45	42	39
	40	118	59	54	49	45	42	39	37	35
9½	5	1876	938	852	782	722	670	625	585	552
	10	936	468	425	390	360	334	312	292	275
	15	624	312	283	260	240	223	208	195	183
	20	468	234	212	195	180	167	156	146	138
	25	376	188	171	157	145	134	125	117	111
	30	312	156	142	130	120	111	104	97	92
	35	268	134	122	112	103	96	89	84	79
	40	236	118	107	98	91	84	79	74	69

sprayer is delivering a specified volume per acre at a specified speed and nozzle spacing.

SPRAYER SPEED (MPH)

	3.6	3.8	4.0	4.2	4.4	4.6	4.8	5.0	5.5	6.0	7.0	8.0
4	117	112	106	101	97	93	89	81	74	64	56	48
2	59	56	53	51	48	46	45	41	37	32	28	24
1	39	37	35	34	32	31	30	27	25	21	18	16
1	29	28	26	25	24	23	22	20	18	16	14	12
5	23	22	21	20	19	18	17	16	15	14	13	12
1	12	11	10	9	8	7	6	5	4	3	2	1
8	235	223	212	202	194	186	178	162	149	128	112	96
4	117	112	106	101	97	93	89	81	74	64	56	48
2	78	74	70	67	64	62	59	54	49	42	37	32
2	58	56	53	50	48	46	44	40	37	32	28	24
9	47	45	42	40	39	37	36	32	30	25	22	19
1	39	37	35	34	32	31	30	27	25	21	18	16
6	34	32	30	29	28	27	26	23	21	18	16	14
1	29	28	27	25	24	23	22	20	18	16	14	12
6	469	446	425	405	387	371	357	325	298	255	223	192
8	235	223	212	202	194	186	178	162	149	128	112	96
5	156	148	141	134	128	123	118	108	99	85	74	64
3	117	111	106	101	96	92	89	81	74	63	56	48
9	94	89	85	81	77	74	71	65	59	51	44	37
2	78	74	70	67	64	62	59	54	49	42	37	32
1	67	64	61	58	56	53	51	47	43	37	32	28
2	59	56	53	51	49	47	45	41	37	32	28	24
0	123	117	112	106	102	98	94	85	78	67	59	51
5	62	59	56	53	51	49	47	43	39	33	29	24
3	41	39	37	35	34	32	31	28	26	22	20	17
3	31	29	28	27	25	24	23	21	20	18	16	14
6	25	24	22	21	20	20	19	17	16	14	13	12
2	21	20	19	18	17	16	15	14	13	12	11	10
1	12	11	10	9	8	7	6	5	4	3	2	1
0	247	235	223	213	204	195	188	171	157	134	117	100
7	123	117	111	106	102	97	94	85	78	67	59	51
5	82	78	74	71	68	65	62	57	52	45	39	32
5	62	59	56	53	51	49	47	43	39	33	29	24
2	49	47	45	43	41	39	38	34	31	27	24	20
3	41	39	37	35	34	32	31	28	26	22	20	17
7	35	34	32	30	29	28	27	24	22	19	17	14
3	31	30	28	27	26	25	24	21	20	18	16	14
2	493	469	446	426	407	390	375	341	313	268	235	202
0	246	234	223	212	203	195	187	170	156	134	117	100
3	164	156	149	142	135	130	125	114	104	89	78	67
0	123	117	111	106	102	97	94	85	78	67	59	51
5	99	94	89	85	82	78	75	68	63	54	47	40
7	82	78	74	71	68	65	62	57	52	45	39	32
5	70	67	64	61	58	56	54	49	45	38	34	28
6	62	59	56	54	51	49	47	43	39	34	30	24

Table 2. Number of seconds required for delivery of 1 quart from 1 nozzle when a sprayer at a specified speed is applying a specified volume per 13068 row feet of a band of any width from 2 nozzles per row.¹

MPH	Speed		Gallons/13068 row feet from 2 nozzles													
	300 feet	per row	4	5	6	7	8	10	12	14	16	18	20			
2.2	93		506	405	338	289	253	202	169	145	127	112	101			
2.4	85		464	371	309	265	232	186	155	133	116	103	93			
2.6	79		428	343	286	245	214	171	143	122	107	95	86			
2.8	73		398	318	265	227	199	159	133	114	99	88	80			
3.0	68		371	297	248	212	186	148	124	106	93	82	74			
3.2	64		348	278	232	199	174	139	116	99	87	77	70			
3.4	60		328	262	218	187	164	131	109	94	82	73	66			
3.6	57		309	248	206	177	155	124	103	88	77	69	62			
3.8	54		293	234	195	167	147	117	98	84	73	65	59			
4.0	51		278	223	186	159	139	111	93	80	70	62	56			
4.2	49		265	212	177	152	133	106	88	76	66	59	53			
4.4	46		253	202	169	145	127	101	84	72	63	56	51			
4.6	44		242	194	161	138	121	97	81	69	61	54	48			
4.8	43		232	186	155	133	116	93	77	66	58	52	46			
5.0	41		223	178	149	127	111	89	74	64	56	49	45			
5.2	39		214	171	143	122	107	86	71	61	54	48	43			
5.4	38		206	165	138	118	103	82	69	59	52	46	41			
5.6	37		199	159	133	114	99	80	66	57	50	44	40			
5.8	35		192	154	128	110	96	77	64	55	48	43	38			
6.0	34		186	149	124	106	93	74	62	53	46	41	37			
7.0	29		159	127	106	91	80	64	53	45	40	35	32			

¹Use primarily for calibration of band-type postemergence sprayers having 2 nozzles per row (or for 4 nozzles per row where only the two inside or drill-spraying nozzles are to be calibrated)

2. Select a convenient gear and throttle setting for operation of the sprayer. Then determine the speed of the sprayer in this gear and throttle setting by timing the number of seconds it takes the sprayer to travel 300 feet under field operating conditions. Be sure that sprayer is operating at full speed before it enters the marked course of 300 feet. A stop watch marked in minutes and seconds and a 100-foot tape are necessary to do a good job of calibration. If permanent markers can be set for the beginning and end points of the 300-foot course, it will make future calibrations easier. Speed may be converted to miles per hour by reference to table 1 or 2. If your sprayer is equipped with speedometer, you should use the above procedure to check its accuracy from time to time.

3. Use tables 1-4 to determine the spray delivery requirement for each nozzle in seconds per quart for the selected rate of application and the determined rate of speed. Table 1 applies to band spraying with 1 nozzle per row, while table 2 applies to band spraying with 2 nozzles per row. Both tables 1 and 2 are expressed

in gallons per 13,068 feet of row. This procedure is used because many growers have 40-inch rows and 13,068 feet of 40-inch row equals 1 acre. This is inconvenient for other row widths only when computing the amount of herbicide needed to treat a given acreage. The volumes expressed may be applied to any desired band width.

Table 3 is for broadcast spraying, and covers collectively 6 common nozzle spacings. The calibration information for broadcast spraying is expressed in familiar gallons-per-acre terms.

4. Use figures 5 to select the nozzles having the right size orifice. This figure can be used also to determine the approximate spraying pressure.

5. Install the nozzles in the sprayer and adjust the spraying pressure until each nozzle delivers 1 quart in the number of seconds determined in step 3 above.

6. Adjust the spacing direction and height of all nozzles to give the desired placement of spray. This step is listed last because it frequently is difficult to catch the spray material from the nozzles in the proper spraying position.