

THE RELATION BETWEEN GRAIN AND STRAW WEIGHT IN THE PADDY CROP

J. C. HAIGH, Ph.D.,
BOTANIST

IT is generally believed that a paddy crop yields half as much again in straw as it does in grain. In a paper which appeared in this Journal in August, 1938 (Haigh, J. C.—Studies on Paddy Cultivation VIII. The Effect of Spacing and Method of Planting on Yield. *The Tropical Agriculturist*, XCI, No. 2, August 1938, p. 71), there are data which make it possible to calculate the relationship between grain and straw weight with some degree of accuracy. Tables II and VII in that paper give the yields of grain and straw from 144 plots during the *yala* 1936 season, and tables IV and IX give corresponding figures for the *maha* 1936–37 season.

Ignoring for the moment the fact that the plots had been treated in various ways, and the possibility that the relationship between grain and straw may have been affected by some of those treatments, and treating each season's figures as 144 pairs of records, we can determine the correlation between grain and straw weight. In table I the data are condensed into frequency arrays, and for convenience in working, the weights have been grouped to the nearest pound, the necessary correction (1/12) being made in the determination of the second moment. The ratios between straw and grain weights are seen to be 1.57 in the *yala* season and 1.35 in the *maha* season. The longer period of growth during the *maha* season has resulted in an increased weight of straw, but an even greater weight of grain.

Tables II and III are correlation tables for the two seasons. The correlation coefficients are high and almost identical (+ 0.79 for *yala* and + 0.76 for *maha*), indicating a close and consistent relationship between the two variables.

The validity of the assumption that there has been no effect of treatment on the relationship between grain and straw weights can be tested by the determination of the covariance. The analyses of covariance for the two seasons are given in Table IV and from these analyses have been calculated the coefficients of correlation ($r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$) for total effects and for treatment effects. These coefficients do not differ

significantly from one another, indicating that treatment has had no effect on the grain-straw relationship. The strength of this relationship is further shown by the high degree of significance of the regression between grain and straw weights, which in each case exceeds odds of 1,000 to 1.

From these data, therefore, we conclude: 1, that there is a strong relationship between the amounts of grain and straw produced in a paddy crop.

2. That the relative weights of straw and grain produced are about 4 : 3 in the *maha* season and 3 : 2 in the *yala*.

3. That the relationship has not been seriously affected by different spacings or by different types of soil.

TABLE I
Yields of Grain and Straw in lb.

Class	Yala 1936		Maha 1936-37	
	Grain	Straw	Grain	Straw
0.5-	1.5	..	..	..
1.5-	4.0	..	2.0	..
2.5-	3.5	..	3.0	..
3.5-	12.5	..	1.0	..
4.5-	8.6	..	4.0	..
5.5-	10.5	..	3.0	..
6.5-	18.5	..	6.0	..
7.5-	23.0	..	10.0	..
8.5-	28.5	..	7.0	..
9.5-	8.5	..	19.0	..
10.5-	8.5	..	10.0	..
11.5-	4.5	..	17.0	..
12.5-	5.0	..	6.0	..
13.5-	5.0	..	9.0	..
14.5-	1.0	..	15.0	..
15.5-	1.0	..	10.0	..
16.5-	..	..	1.0	..
17.5-	..	..	5.0	..
18.5-	..	..	1.0	..
19.5-	..	..	6.0	..
20.5-	..	..	1.0	..
21.5-	..	..	3.0	..
22.5-	..	..	1.0	..
23.5-	..	..	—	..
24.5-	..	..	2.0	..
25.5-	..	..	2.0	..
	144	144	144	144
Means	Grain .. 7.94 ± 0.25 lb.	Grain — .. 9.78 ± 0.28 lb.	Grain — .. 9.78 ± 0.28 lb.	Grain — .. 9.78 ± 0.28 lb.
	Straw .. 12.44 ± 0.41 lb.	Straw — .. 13.20 ± 0.32 lb.	Straw — .. 13.20 ± 0.32 lb.	Straw — .. 13.20 ± 0.32 lb.
D	Grain .. 2.97 ± 0.17 lb.	Grain — .. 3.33 ± 0.20 lb.	Grain — .. 3.33 ± 0.20 lb.	Grain — .. 3.33 ± 0.20 lb.
	Straw .. 4.89 ± 0.29 lb.	Straw — .. 3.87 ± 0.23 lb.	Straw — .. 3.87 ± 0.23 lb.	Straw — .. 3.87 ± 0.23 lb.
	Ratio of straw/grain = 1.57	Ratio of straw/grain = 1.35	Ratio of straw/grain = 1.35	Ratio of straw/grain = 1.35

TABLE IV
Analysis of Covariance

Yala, 1936

	Degrees of Freedom	x^2	xy	y^2	r
Blocks	.. 15	.. 395.40	.. 1,110.44	.. 1,004.77	..
Treatments	.. 23	.. 657.42	.. 789.43	.. 1,546.60	.. +0.78
Error	.. 105	.. 214.92	.. -235.47	.. 898.06	..
Total	.. 143	1,267.75	1,664.40	3,449.44	+0.80

	D. F.	Sum of Squares	Mean Square	Log_e SD
Regression	.. 1	.. 258.1	.. 258.1	.. 2.7767
Deviations from regression	.. 104	.. 640.0	.. 6.1	.. 0.9041

$z = 1.8726$

For $n_1 = 1$, $n_2 = 120$, $P = 0.001$, $z = 1.2158$.
Odds are 1,000 to 1 that the regression is significant.

Maha, 1936-37

	Degrees of Freedom	x^2	xy	y^2	r
Blocks	.. 15	.. 195.45	.. 226.91	.. 330.68	..
Treatments	.. 23	.. 1,022.52	.. 933.81	.. 1,199.10	.. +0.84
Error	.. 105	.. 323.51	.. 253.53	.. 602.47	..
Total	.. 143	1,541.48	1,414.25	2,132.25	+0.78

	D. F.	Sum of Squares	Mean Square	Log_e SD
Regressions	.. 1	.. 198.6	.. 198.6	.. 2.6457
Deviations from regression	.. 104	.. 403.9	.. 3.883	.. 0.6783

$z = 1.9674$

For $n_1 = 1$, $n_2 = 120$, $P = 0.001$, $z = 1.2158$.
Odds are 1,000 to 1 that the regression is significant.

TABLE II
Yield of Straw and Grain, Yala 1936

$r = +0.79$

Yield of Straw in Pounds.

	1.5-	2.5-	3.5-	4.5-	5.5-	6.5-	7.5-	8.5-	9.5-	10.5-	11.5-	12.5-	13.5-	14.5-	15.5-	16.5-	17.5-	18.5-	19.5-	20.5-	21.5-	22.5-	23.5-	24.5-	25.5-	Total
0.50-	1.0	0.5																								1.5
1.50-	1.0	2.5		0.5			1.0	1.0																		4.0
2.50-				0.5			2.5	2.0	2.0																	3.5
3.50-			1.0	2.0	2.0		3.5	1.0	2.0	2.0																12.5
4.50-				2.0	2.0		2.0	2.0	4.0	3.0	1.5	2.0	2.0	1.0	1.0											8.5
5.50-				1.0			1.0	2.0	2.0	2.0	4.5	1.0	2.0	3.0	1.0											10.5
6.50-							2.0	2.0	4.5	3.0	6.5	1.5	1.0	7.5	2.5	1.0			1.0							18.5
7.50-							1.0	1.0	6.5	1.0	0.5	0.5	1.0	1.0	1.5	1.0	1.0	1.0	2.0	1.0						23.0
8.50-					1.0					1.0	0.5	0.5	3.0	0.5	0.5	1.0	1.0	1.0	2.0	1.0				1.0		28.5
9.50-											1.5	1.5		0.5	1.5	1.5	1.0	1.0	1.0	1.0						8.5
10.50-											1.5	1.5		1.5	2.0	2.0	2.0	1.0	1.0	2.0	1.0					4.5
11.50-														1.0			2.0		1.0	1.0	1.0					5.0
12.50-														1.0			2.0		1.0	1.0						1.0
13.50-														1.0					1.0	1.0						1.0
14.50-																										1.0
15.50-																										1.0
Total	2.0	3.0	1.0	4.0	3.0	6.0	10.0	7.0	19.0	10.0	17.0	6.0	9.0	15.0	10.0	1.0	5.0	1.0	6.0	1.0	3.0	1.0	—	2.0	2.0	144

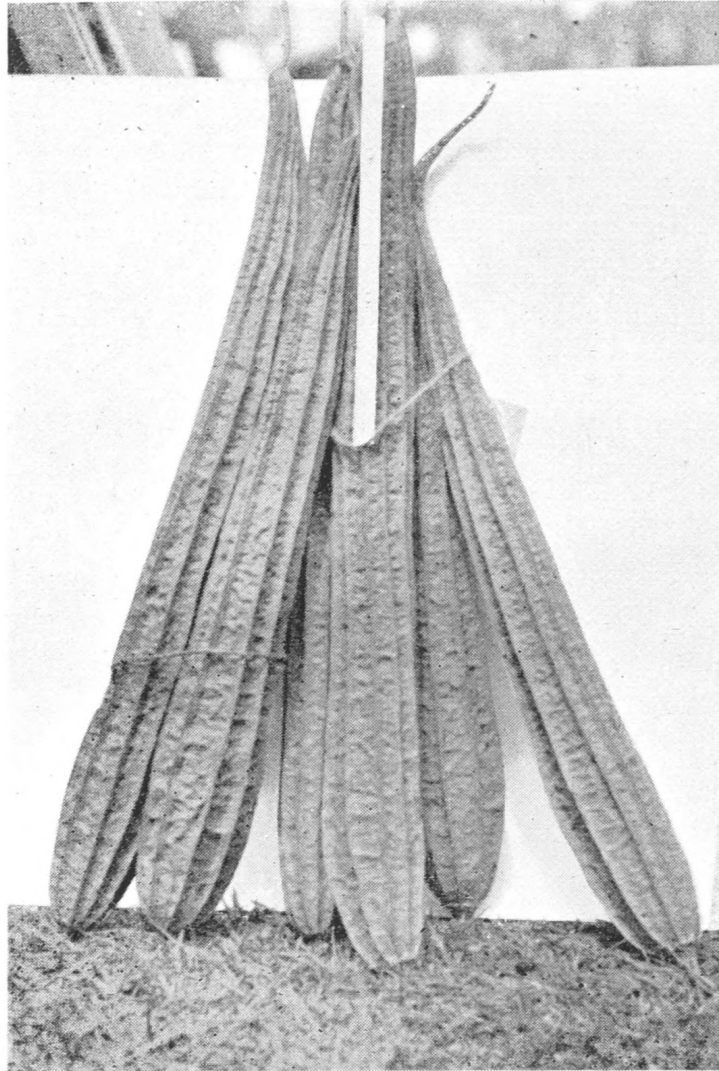
Yield of grain in pounds.

TABLE III
Yield of Straw and Grain, *Maha* 1936-37

$r = +0.76$

Yield of Straw in Pounds

Yield of grain in pounds.	2.50-	3.50-	4.50-	5.50-	6.50-	7.50-	8.50-	9.50-	10.50-	11.50-	12.50-	13.50-	14.50-	15.50-	16.50-	17.50-	18.50-	19.50-	20.50-	21.50-	22.50-	23.50-	Total.	
2.50-	0.5																							4.0
3.50-	0.5	2.5																						4.0
4.50-				1.0	2.0	0.5	0.5	1.0	0.5	1.0	2.0													10.0
5.50-				1.5	4.0	0.5	2.0	1.0	1.5	2.0	1.5	3.5	0.5											7.5
6.50-					0.5		1.0	2.0	2.0	1.5	2.0	1.0	1.0											13.0
7.50-							2.75	2.25	1.5	3.75	3.25	3.0	1.0											12.5
8.50-							2.25	1.75	1.5	2.25	1.75	3.0	1.0											15.5
9.50-							0.5	2.0	2.5	2.25	1.75	3.0	1.0											14.0
10.50-								1.0	2.5	1.0	0.5	3.0	1.5	2.0	1.0	1.0	1.0							17.0
11.50-									2.5	1.5	1.5	2.5	3.5	3.5	2.0	1.5	1.0	0.25	0.25					12.5
12.50-									1.5	0.5	0.5	1.5	3.5	2.0	1.0	2.5	1.0	0.25	1.25					13.0
13.50-									0.5			0.5	3.5	1.5	1.0	2.5	0.5	1.0	0.5	0.5	0.5	0.5		5.0
14.50-												0.5	0.5	1.5	1.0	0.5	1.5	1.0	1.0					1.5
15.50-												0.25	0.25	0.25	0.25	0.5	1.0	0.25	1.0					1.5
16.50-												0.25	0.25	0.25	0.25	0.5	1.0	0.25	1.0					0.5
17.50-																								0.5
Total	0.5	2.5	—	2.5	6.5	3.5	9.0	12.0	10.5	14.0	13.0	16.0	15.0	13.5	6.5	6.0	5.0	2.5	4.0	0.5	0.5	0.5	0.5	144



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