Original Articles.

A Yield Trial with Pure-Line Paddies at the Belunmahara Paddy Seed Station.

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THE Belunmahara Paddy Seed Station is in the Low-Country of Ceylon and is situated about 15 miles from Colombo along the Colombo-Kandy Road. The paddy-fields in the district are mainly rain-fed but a precarious amount of irrigation water is available. In the vicinity of the Station the fields are cropped once a year during the north-east monsoon and a $5\frac{1}{2}$ to 6 months paddy—often heavily awned—is grown. The Station was opened in1926 and the first yield trial with pure-line paddies was laid down during the Maha (N.E.) season of 1926-27. As a result of that trial nine pure-lines were selected for a more elaborate trial during *Maha*, 1927-28. Long, narrow plots 6 ft. 6 in. by 33 ft. (=1/200 ac.) were used in the trial and each pure-line was replicated ten times. Each replication was in as compact a block as possible and the position of the plots in each replication was deliberately randomized.* This random arrangement is shown diagrammatically in Table I.

* See Fisher, R.A. Statistical Methods for Research Workers 1925.

Table I.

Showing Random Arrangement of Plots

(diagrammatic.)

a	b	c	d	e
I-17	G-3	W-15	I-17	i-10
Local	Local	i-10	i-10	a-12
G-3	k-7	E-24	a-12	E-24
i-10	C-14	I-17	b-13	k-7
b-13	I-17	a-12	W-15	W 15
W-15	a-12	k-7	k-7	G-3
k-7	b-13	G-3	C-14	Local
C-14	i-10	C-14	E-24	I-17
E-24	W-15	b-13	Local	C-14
a-12	E-24	Local	G-3	b-13

f	g	h	i	j
E-24	a-12	I-17	I-17	i-10
b-13	W-15	k-7	E-24	b-13
k-7	C-14	b-13	G-3	k-7
i-10	i-10	i-10	i-10	G-3
W-15	G-3	a-12	a-12	W-15
a-12	Local	Local	C-14	Local
G-3	b-13	W-15	Local	a-12
Local	k-7	G-3	b-13	I-17
I-17	E-24	E-24	k-7	C-14
C-14	I-17	C-14	W-15	E-24

Table II.

Yield of grain in quarter lbs. Belunmahara Trials, Maha 1927-28.

Selection or Variety.		Block a	b	c	d	e	f	g	h	i	j	Total.	Mean.
b-13	...	63	60	56	54	42	54	57	60	58	41	545	54·5
k-7	...	56	52	33	44	52	55	50	56	44	56	498	49·8
G-3	...	56	55	40	54	40	54	52	40	46	50	487	48·7
a-12	...	42	44	40	60	50	44	40	60	48	49	477	47·7
E-24	...	40	38	48	44	42	51	40	40	52	43	438	43·8
Local Paddy (Control)	...	52	40	36	33	40	40	36	44	37	41	399	39·9
I-17	...	38	50	42	46	36	32	36	40	40	32	392	39·2
C-14	...	50	36	41	24	28	40	33	36	48	40	376	37·6
W-15	...	39	32	36	28	32	39	36	42	38	32	354	35·4
i-10	...	30	28	28	35	28	33	32	34	28	36	312	31·2
Total	...	466	435	400	422	390	442	412	452	439	420	4278	42·78

The different paddies were sown on the 1st and 2nd August, 1927, and were harvested during January and February, 1928. Table II. gives the yields in quarter lbs. of each selection in the different replications. Using the methods of R. A. Fisher (*op. cit.*) the following results are obtained:—

Variance between	Degrees of Freedom	Sum of Squares	Mean Square	S. D.	Log S.D.
Blocks	9	496·96			
Varieties	9	4834·36	537·151	23·18	3·1432
Experimental Error	81	2993·84	36·956	6·08	1·8050
Total	99	8325·16			Diff. 1·3382

Whether an experiment is sufficiently accurate to differentiate between the yields of varieties depends on whether the variance derived from " varieties " is greater than the variance derived from " experimental error." If the variance due to varieties is significantly greater the experiment may be assumed to differentiate between the varieties tested and the more striking differences between them may be relied on as being a valid estimate of the true differences. The significance of the difference between the two variances is ascertained by the z test (see Fisher *op. cit.*) z is the difference between the natural logarithms of the corresponding standard deviations (or half the difference of the natural logarithms of the variances). In this experiment $z = 1{\cdot}3382$. With a probability of 0·05 (odds of 1 in 20) and for $n_1 = 8$ and $n_2 = 24$ $z = {\cdot}4283$. It is obvious therefore without interpolation that for $n_1 = 9$ and $n_2 = 81$ that a value for z of 1·3382 shows the difference between the two variances to be significant and, therefore, the more marked differences between the varieties tested to be reliable.

The results of the trial may be tabulated as follows:—

Selection	Varietal Extraction		Age at Flowering days	Age at Maturity days	Total Yield in lbs. 10 plots (i. e. 1/20 ac.)	Yield as a Percentage of the Control
b-13	Kurulutuduwi	...	140	139	136·25	136·5
k-7	Surasamba	...	137	173	124·50	124·8
G-3	Maha Mawi	...	138	191	121·75	122·05
a-12	Podiwi	...	140	188	119 25	119·5
E-24	Kalukanmawi	...	144	190	109·50	100 7
Local	Paddy (Suduwi)	...	124	166	99·75	100
I-17	Mawi	...	157	204	98·00	98·2
C-14	Kuru Mawi	...	144	198	94·00	94·2
W-15	Mawi	...	139	185	88·50	88·7
i-10	Puluksamba	...	140	188	78·00	78·2

There is strong evidence to regard the pure-line selections b-13, k-7, G-3, and probably a-12 also, as definitely higher yielders than the local paddy. The standard error of the difference between two selections is 6·55% which also indicates that the four top-yielders are significantly better than the local paddy. The increased yield of b-13 (36%) is very satisfactory and is larger than can normally be expected. The trials will be repeated during *Maha* 1928-29 with b-13, k-7, G-3, a-12 and certain other selections. It is interesting to note that the Divisional Agricultural Officer, Central Division, has found G-3 to head the trials at Mattamagoda and the Senior Agricultural Instructor, Ratnapura, has found G-3 to head the trials at Batugedera; b-13 is a very similar paddy to G-3 and has not yet been tested elsewhere. If its superiority over G-3 is maintained at Belunmahara and proved at other Stations it will be suitable for growing in a very large area. The grain of b-13 is larger than the grain of G-3. The respective measurements are given below:—

Variety		Paddy		Rice	
		Length m.m.	Breadth m m.	Length m.m.	Breadth m.m.
b-13	...	7·34	3:225	5·53	2·735
G-3	...	7·015	3·08	4·985	2·60

As the villager prefers a large, bold grain b-13 has an additional advantage over G-3.