水稻収量予察の作物学的研究 (予報)

IV. 生育時期別乾物重・その成長曲線並に相対成長率と豊凶との関係*

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Crop-scientific studies on the yield-forecast of lowland rice

(Preliminary report)

IV. Relations of dry-weights in different growth-stages, their growth-curves and relative growth rates to the goodness of yields in rice

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旧農林省農事試験場鴻巣試験地の豊凶考照試験の資料と目下著者等が実施中の遮光試験の資料を用い、生育時期別乾物重と収量との相関係数 (第 1, 2 表, $n=7$) (第 3 表, $n=8$) (第 4 表, $n=6\sim 8$), Robertson (1908) による乾物重の成長曲線式と豊凶との関係 (第 5 表), Briggs, Kidd and West (1920) [$R=100 \times (\log_e w_2 - \log_e w_1) \div (t_2 - t_1)$] による生育各期の乾物重の相対成長率と収量との相関係数 (第 6, 7 表, $n=7$) を検討した結果、乾物重の追跡が収量予察上に特に大きな役割を果すとは思われなかつた。この方法を効果的にする為には、測定個体の Sampling 方法が検討されると共に、乾物の量のみでなく質の研究が行われる必要があろう。

Summary The authors examined the value of measuring dry-weights of rice plants for forecasting yields of the crop, using the data (I) (1929-1935), (II) (1936-1944) of experiments on climate-adaptability of the plant at Konosu Agricultural Experiment Farm and the data (III) of artificial shading experiments carried out at the same place in 1950 and 1951 by the authors. And the results obtained are summarized as follows:

(1) In the field where the growth was normal positive correlation coefficients were almost always found between yields of kernels and dry weights of plants at different growth stages in the 9 varieties tested. Early varieties showed significantly high coefficients at every time shortly after transplanting, but most of other varieties did not show significant correlations at any times up to heading (Table 1, 2)

(2) In the field where the growth of rice plants became slender at the end of growing season, an early variety and a medium one showed significantly high coefficients at 12 days before heading and at heading time respectively, but late one showed very low values in all stages. (Table 3)

(3) From the data (III) of shading experiments, in which the growing rice plants of a medium variety were covered with clothes in different stages, slightly significant coefficients were obtained at the stage 5 days before and 14 days after heading. (Table 4)

(4) Robertson's growth-curve equations of dry-weights for 3 varieties in 7 years were derived from the data (I), and the relations of crop yields to the equations were investigated with special reference to their "K" which is termed the coefficient of growth. The results showed no close relation between them. (Table 5)

(5) As a result of examining the correlations of yields with the value of relative weight-growth rates calculated from the data (III) at an interval of 6 days after transplanting, there were found mostly low coefficients between them (Table 6, average value of 3 medium varieties). And also the correlations of yields with the values calculated at a long interval did not show significant coefficients, except in the case of early stage of early varieties. (Table 7)

(6) It was suggested from the results above mentioned, that tracing up the dry-weights through the growing period would not play any important role in forecasting yields in rice. In order to make the dry-weights of the plant valuable as the indexes to yield-forecast it should be born in mind that, firstly, methods of sampling plants to be weighed should be re-examined, and secondly, not merely the quantity of dry-matter but also the quality of it should be considered.

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Table 1.

Date	Early Mu-bo-aikoku		Medium Sen-ichi		Late Oseki	
Variety	A	B	A	B	A	B
June 25	.34		.25		.46	
July 15	.95**	.90**	.15	.26	.35	.22
21	.94**	.90**	.26	.26	.52	.54
27	.85**	.79**	.26	.42	.16	.28
Aug. 2	.44	.72	.12	.44	.25	.32
8	.59	.71	.57	.54	.37	.36
14	.75	.68	.66	.65	.61	.43
20	.53	.64	.67	.62	.08	.45
26	.57	.60	.63	.68	.49	.51
Sep. 1	.36	.57	.24	.65	.74	.52
7	.44	.59	.64	.68	.48	.60
13	.44	.61	.43	.71	.63	.66
19	.64	.63	.61	.80**	.97**	.72
25	.56	.62	.68	.88**	.63	.79**
Oct. 1	.63	.58	.86**	.91**	.87**	.82**
7	.38		.87**	.92**	.64	.83**
13			.94**	.92**	.92**	.82**
19			.70		.56	.80**
25					.72	.79**
31					.63	

Note: "A" means correlation coefficients calculated from observed values, "B" from theoretical values.

Table 5. $\log \frac{Y}{A-Y} = K(t-t_a)$

Year	Mubo-aikoku				Sen-ichi				Oseki			
	Yield	K	A	ta	Yield	K	A	ta	Yield	K	A	ta
1929	197	.029	54.9	63	233	.028	63.5	63	182	.034	70.7	66
1930	234	.024	51.8	54	275	.029	78.7	57	247	.034	85.0	68
1931	199	.028	38.4	62	227	.027	50.2	61	199	.034	59.5	63
1932	179	.029	51.6	56	248	.026	60.0	58	194	.033	66.7	76
1933	230	.023	50.7	57	263	.026	62.1	56	230	.032	69.8	60
1934	210	.024	42.8	54	193	.028	51.7	57	181	.037	63.5	64
1935	206	.027	42.4	54	217	.030	55.4	61	165	.032	60.3	63

Note; (1) A=the maximum dry-weight, Y=the dry-weight at any time t, ta=the time at which the weight of the plant is half of A, and K=a constant, (2) The values of K are all significant (0.05).

Table 6.

Period	r	Period	r
June 25~July 3	.30	26~Sep 1	.63
July 3~9	.27	Sep 1~7	.67
9~15	.66	7~13	.44
15~21	.12	13~19	.83**
21~27	.13	19~25	.21
27~Aug 2	.06	25~Oct. 1	.07
Aug 2~8	.61	Oct. 1~7	.41
8~14	.15	7~13	.53
14~20	.19	13~19	.02
20~26	.28		

Table 2.

Date	Early		Medium		Late	
Variety	A	B	C	D	E	F
June 25	.89**	.79*	.61	.55	.04	.78*
July 15	.64	.90**	.53	.39	.17	.55
27	.39	.82*	.35	.55	.11	.27
Aug. 8	.30	.26	.38	.40	.35	.29
21	.59	.54	.64	.87*	.51	.62
Sep. 1	.69	.39	.57	.60	.66	.41
13	.89**	.69	.88*	.36	.57	.57
25	.39	.68	.73	.95**	.32	.75
Oct. 7	.81*	.49	.92**	.86*	.38	.42
19			.97**	.44	.61	.43
31					.16	.52

Note; A, B, C, D, E, and F are names of varieties representing Karasu, Shinshu, Tsurugi, Sekitori, Sugaippon and Shimebari, respectively.

Table 3.

Date	A	B	C
July 15	.03	.50	.01
27	.43	.52	.13
Aug 8	.88**	.69	.13
20	.85**	.61	.18
Sep 1	.72*	.88**	.01
13	.91**	.73*	.11
25	.92**	.61	.15
Oct 7		.67	.08

Note; A(Mubo-aikoku)
B(Sen-ichi), C(Oseki)

Table 4.

Date	1950	1951
Aug. 8	.77	
25	.91*	.75*
Sep. 14		.83*

Table 7.

Variety	Period			
	I	II	III	IV
Early	.91**	.72	.34	.10
Medium	.60	.05	.60	.53
Late	.34	.30	.21	.17

I...June 25~July 15, II...July 15~Aug. 2,
II...From the stage beginning of Young panicle formation to heading time.
IV...For 24 days after heading