Germination of indica rice seeds in relation to water depth and salinity

Seed germination was compared between indica and japonica rice in relation to water depth, oxygen deficiency and water salinity at the Rice Department (now Department of Agriculture) of Thailand.

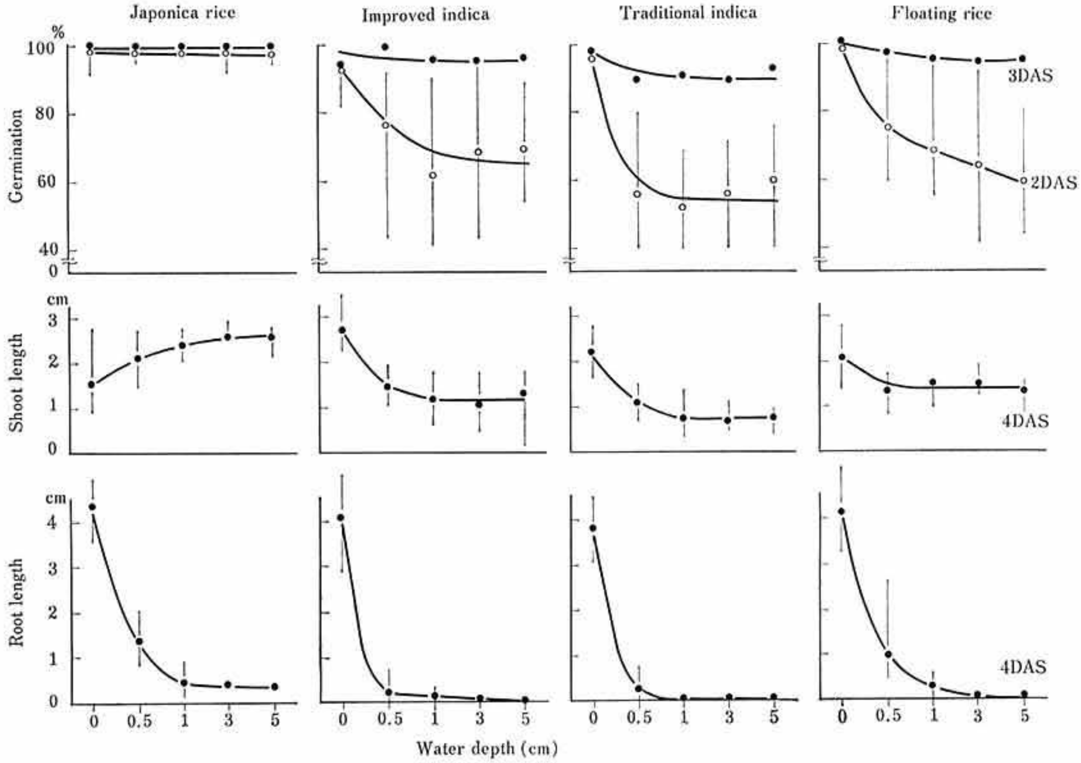
With increasing water depth of seed-beds, indica rice (three traditional varieties: Puang Nahk 16, Leuang Pratew 123, Nang Mon S-4; three improved varieties: RD-1, Leuang Tawng 17-3, C4-63; and four floating varieties: Jegchey 159, Lebmuenang 111, Pingkeaw 56, Tapawkeaw 161) showed a delay of germination, low percentage of germination, and the retarded growth of plumules and radicles in contrast to japonica lowland rice (Honen-wase, Fujiminori, Koshihikari and Sasashigure) which expressed much faster germination with elongated plumules and less retarded rooting and root growth (Fig. 1).

Germination at different levels of oxygen partial pressure of the atmosphere of seed-beds indicated that indica varieties of Thailand and of other countries were more sensitive to oxygen deficiency than japonica lowland rice (Fig. 2).

Japonica upland varieties showed the same response as that of indica rice. Thus it is apparent that indica rice requires more oxygen than japonica lowland rice for normal germination. This accounts for the varietal difference in germination under submerged condition between indica and japonica rice.

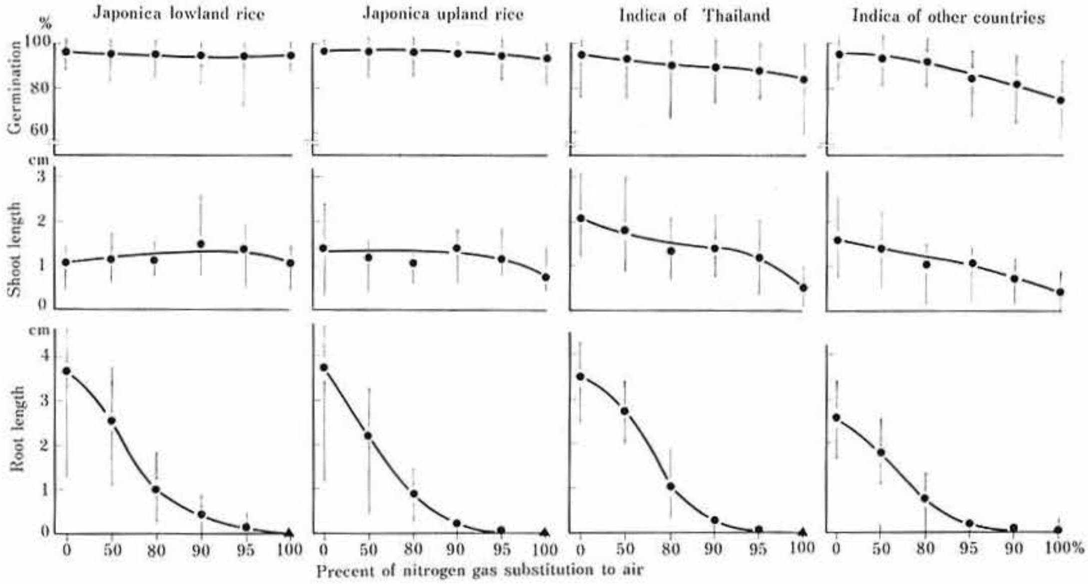
The supply of oxygen to submerged water by air-bubbling was effective in reducing the delay of germination and retarded growth of plumules and radicles of indica rice caused by deep water submergence.

Delay of germination occurred similarly with husked and unhusked seeds, suggesting



DAS=days after sowing

Fig. 1. Germination and seedling growth at different water depths of seed-bed



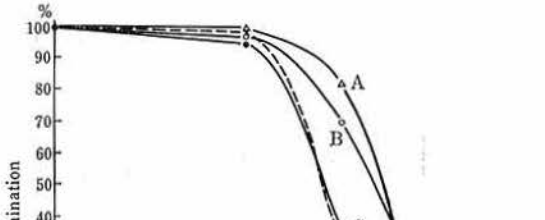
Japonica lowland rice:	Koshihikari, Fujiminori, Sasa-shigure, Honen-wase, Nihonbare, Norin No. 29, Chianung 242 (Formosa), Zenith (U. S. A.)
Japonica upland rice:	Norin No. 10, Norin No. 12, Norin No. 21, Norin No. 24, Ishioka No. 5, Oka-minori, Tachi-minori, Hata-sangoku
Indica of Thailand:	RD-1, Leuang Tawng 17-3, Puang Nahk 16, Leuang Pratew 123, Lebmuenang 111 (floating), Tapawkeaw 161 (floating), Pingkeaw 56 (floating), Leuang 152
Indica of other countries:	C4-63 (Philippines), IR-5 (IRRI), IR-8 (IRRI), Peta (Indonesia), Intan (Indonesia)' SML 242 (Surinum)

Fig. 2. Germination at reduced oxygen partial pressure of air, on 4th day after sowing

that the lag of germination specific to indica seeds is not related to the presence of husks in which a germination inhibitor causing seed dormancy is contained (1).

Water absorption by seeds during germination consists of three phases—A, B and C (2). At phase A, seeds absorb water physically whereas at phase B water absorption takes place by the metabolism of seeds. The lag of germination of indica rice seeds caused by deep water occurred at phase B, suggesting some metabolic difference between indica and japonica seeds.

Pre-soaking or pre-sprouting treatment of indica seeds was effective in increasing germination percentage on water-saturated or shallowly submerged seed-beds, but the effect was almost nullified under a deep water condition.



Improved indica:	RD-1, LT 17-3, C4-63
Traditional indica:	Puang Nahk 16, Leuang Pratew 123, Nang Mon S-4
Floating rice:	Lebmuenang 111, Tapawkeaw 161, Pingkeaw 56, Jegchy 159
Japanese rice:	Koshi-hikari, Fujiminori, Sasa-shigure, Honen-wase

Fig. 3. Germination in relation to NaCl concentration, on 4th day after sowing

Germination was markedly retarded at the concentration of 1.5% of NaCl solution, and no germination occurred at 2.5%. However, apparent varietal differences were observed at 1.5%; traditional indica and floating rice varieties showed 50 to 80% and 70 to 90% germination respectively, while newly improved indica and Japanese varieties showed only 20 to 50% germination (Fig. 3). Japanese varieties harvested in Thailand expressed more resistance to NaCl than the same varieties harvested in Japan, suggesting an influence of growth environment on seed resistance to NaCl.

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An experiment on silkworm culture in Sri Lanka

During the period from March to June 1971, the authors carried out an experiment on silkworm culture at the Central Agricultural Research Institute (CARI) in Sri Lanka as a part of the survey[1] on the possibility of developing the sericulture industry that was undertaken as a cooperative research program between CARI and TARC.

Three races of silkworm—two hybrids (F_1 of Japanese×Chinese variety, bivoltine) and an Indian race (polyvoltine) were used. Although the experiment was conducted on a small scale and it was not repeated due to time limitation, the result obtained indicates that the growth and cocoon production were quite satisfactory as evidenced in Tables 1 to 3 and Plate 1.

Mortality of the worm during the period under review from the first instar to the third instar stage was similar with the case in Japan, and that from the fourth instar to cocooning was also very low due to no incidence of diseases.

The cocoons were slightly heavier than that obtained in Japan but with lower percentage of cocoon shell weight to the whole

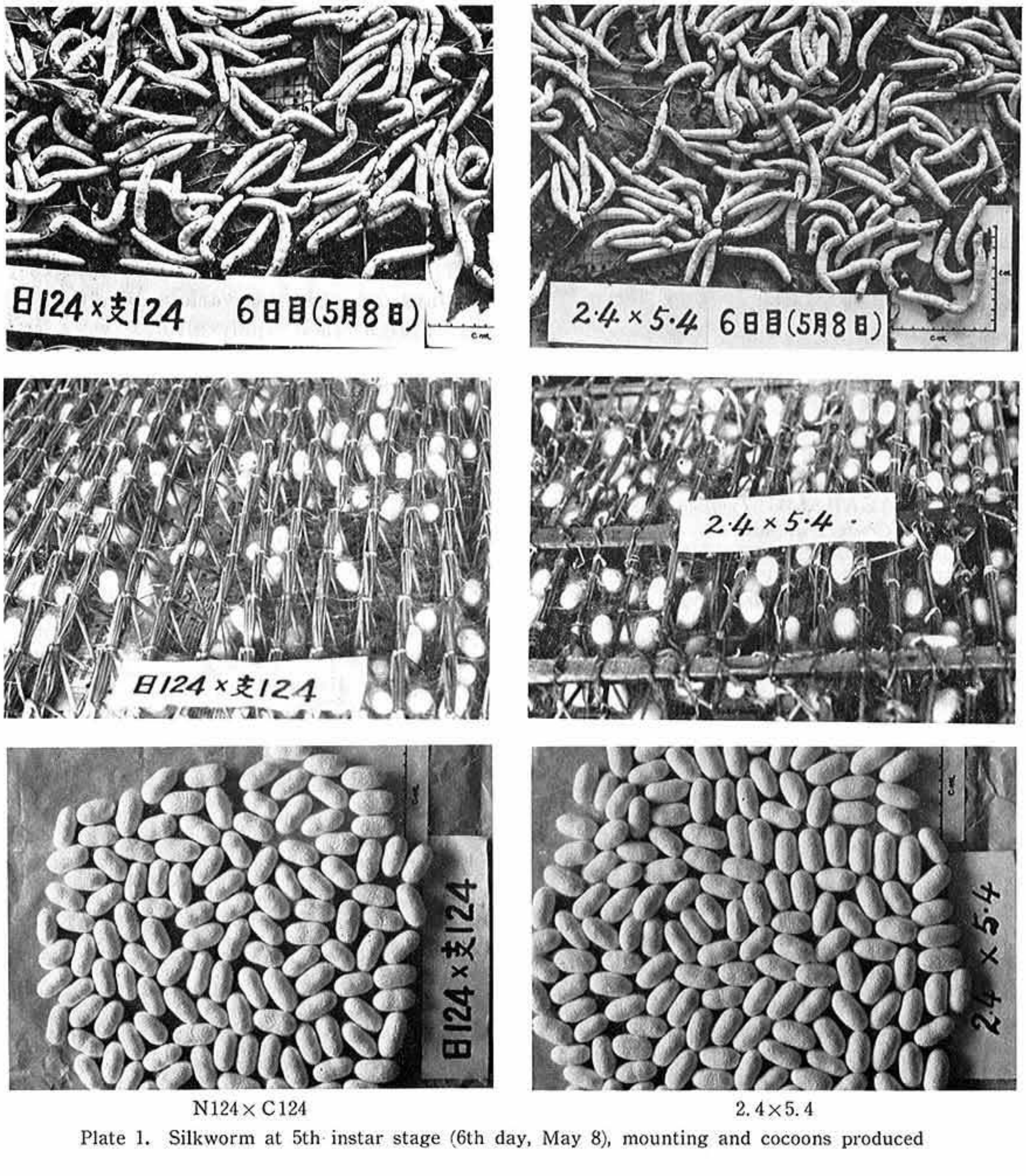
Table 1. Mortality of silkworms

Race	Mortality from 1st to 3rd instar	No. of worms at 4th instar stage	Mortality from 4th instar to cocooning	No. of healthy pupae	Pupation ratio	Cocooning		
						Normal	Double	Total
N124×C124	6%	190	5%	177	93.2%	179	2	181
N2.4×C5.4	4	220	3	211	95.9	213	0	213
Cambodge	8	300	9	267	89.0	268	4	272

Table 2. Cocoon yield

Race	Cocoon yield (g)				No. of cocoons per liter	Per one cocoon*		
	Reelable	Defective	Double	Total		Cocoon weight (g)	Cocoon shell weight (cg)	Shell weight percentage (%)
N124×C124	375	35	4	414	82	2.32	44.6	19.2
N2.4×C5.4	435	35	0	470	80	2.25	46.1	20.5
Cambodge	240	—	2	242	172	0.90	8.7	9.7

* Average of 50 males and 50 females



N124× C124 2.4×5.4

Plate 1. Silkworm at 5th instar stage (6th day, May 8), mounting and cocoons produced

Table 3. Length of larval stage

Race	Length of larval stage (days, hrs.)						Temperature and humidity of rearing room									
	1st instar	2nd instar	3rd instar	4th instar	5th instar	Total	1st instar		2nd instar		3rd instar		4th instar		5th instar	
							°C	%	°C	%	°C	%	°C	%	°C	%
N124 × C124	2. 23	2. 21	3. 08	4. 05	6. 14	19. 23	27. 4	89	27. 0	79	27. 4	82	26. 8	83	27. 6	76
N2. 4 × C5. 4	2. 23	2. 21	3. 08	4. 05	6. 14	19. 23	27. 4	89	27. 0	79	27. 4	82	26. 8	83	27. 6	76
Cambodge	3. 14	2. 22	3. 11	4. 00	5. 00	18. 23	27. 3	86	27. 1	80	27. 2	83	26. 9	83	27. 6	75

(1) Rearing method: 1st to 2nd instar stage covered under paraffin paper
3rd to 5th instar stage uncovered
(2) Feeding time: 9 : 00 a. m. and 14 : 30 p. m. for 1st to 3rd instar stage
7 : 00 a. m., 11 : 00 a. m. and 18 : 00 p. m. for 4th to 5th instar stage
(3) Rearing tray: 60 cm × 90 cm
(4) Rearing room: Entomology Division of CARI
(5) Mulberry leaf storage: Botany Division of CARI (low-temperature room)

cocoon weight perhaps attributed to the high temperature during the period from the fifth instar stage to cocooning and to the quality of the mulberry leaf used in feeding. The temperature was higher than that recognized as optimum in Japan. Relative humidity was 75 per cent to 89 per cent which is nearly optimum. However, effect of humidity during the rainy season is not known from this experiment.

The result furnishes an evidence that sericulture is highly possible in Sri Lanka. However, for a successful industry, further research works will be needed such as selection of mulberry varieties, methods of propagation and harvesting, soil and fertilizer application, as well as selection of silkworm races and control of worm diseases. Controlling the disease is particularly important because the sericulture industry, once set up Jaffna from 1944 to 1956, was destroyed by the incidence of diseases such as muscardine and flachery.

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