

# STUDIES OF THE APPEARANCE OF NECROSIS IN RICE

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## 水稻의 Necrosis 出現에 關한 研究

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### INTRODUCTION

The superiority of the seed depends upon inherent character and posterior character. The percentage of germination, percentage of purity, 1000 grains weight, etc. have been investigated in the laboratory in order to determine the posterior character. Above all, in the judgment of the value of the seeds, however, it is important that the percentage of germination is investigated. The germination rate of the seed, therefore, has been investigated by direct and indirect methods (1, 2, 5, 8, 10, 12)

Because the seeds can lose their vitality, they may not be aroused to germination and eventually may die if placed under unsuitable conditions for a long time. The reason the seeds do not germinate has been studied by physiological and chemical methods (1, 3, 10, 13)

another cause of non-germination that was studied is the phenomenon of necrosis occurring in the tissue of the seed and gradually developing into the other tissue. This study was performed in the embryo of the rice grain to get information on the part in which the necrosis occurs for the first time and on the phenomenon of necrosis that develops into other parts.

I give thanks to Prof. Lee Byoung-Chang and Associate Prof. Kim Yang-Chun, who both gave instruction in this experiment.

### 1. MATERIALS AND METHODS

The seeds of rice used in this experiment were Norin No. 6 that were harvested in the Kyung Pook Provincial Institute of Agriculture for two years. This experiment was carried out by the Palmerston North Method of the Seed Testing Laboratory of New Zealand. A total of 200 seeds, that were equal in size and perfect in form, were counted out into small dishes, and in order to soften them, put in water for 10 hours and cut off as shown in Fig. 1.

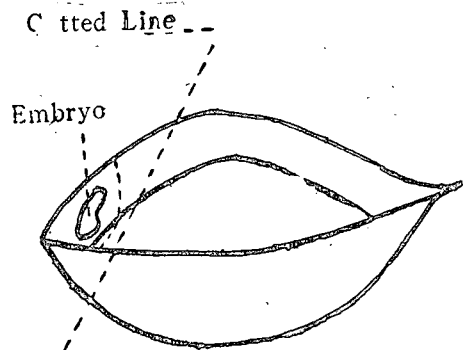


Fig. 1. Side view of a rice grain.

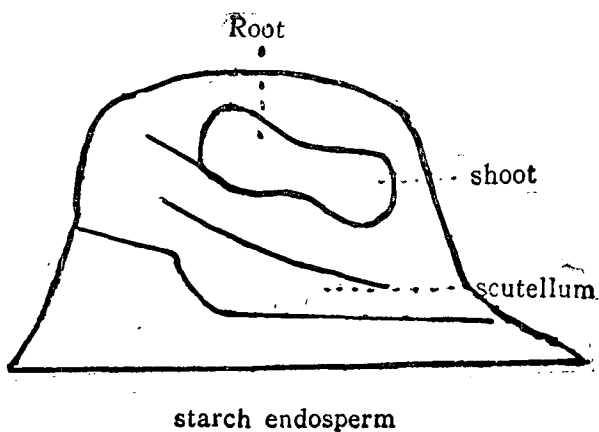


Fig. 2. Side view of emdryo after cutting.

These small pieces of grain were treated with 1% tetrazolium solution (2,3,5.-triphenyltetrazolium chloride,  $C_{19}H_{15}N_4$ , manufactured by E. Merck Co. in Germany) and left in a dark place (Incubator of  $30^{\circ}C$ ) for 20 hours, for the color to develop. After pouring off the tetrazolium solution, small pieces were rinsed

with water two or three times. The phenomenon of the necrosis was investigated with a Ruper, and this experiment was conducted in five replications. The phenomenon of necrosis occurring on the surface and inside, especially in the median longitudinal section of the embryo, was investigated.

A red stain in the tissue where the phenomenon of necrosis didn't occur distinguished the unaffected tissue from the tissue in which necrosis was present (4,10).

## 2. RESULTS AND DISCUSSIONS

The results obtained in this experiment are illustrated in Tables 1, 2, and 3, and in Fig. 1, 2, 3, 4, 5, and 6, and discussion is given below:

A) The necrosis appearance on the surface of the embryo:

The phenomenon of necrosis on the surface of the embryo is shown in Fig. 3, and the frequency of appearance of surface views in the unstained embryo is as shown in Table 1.

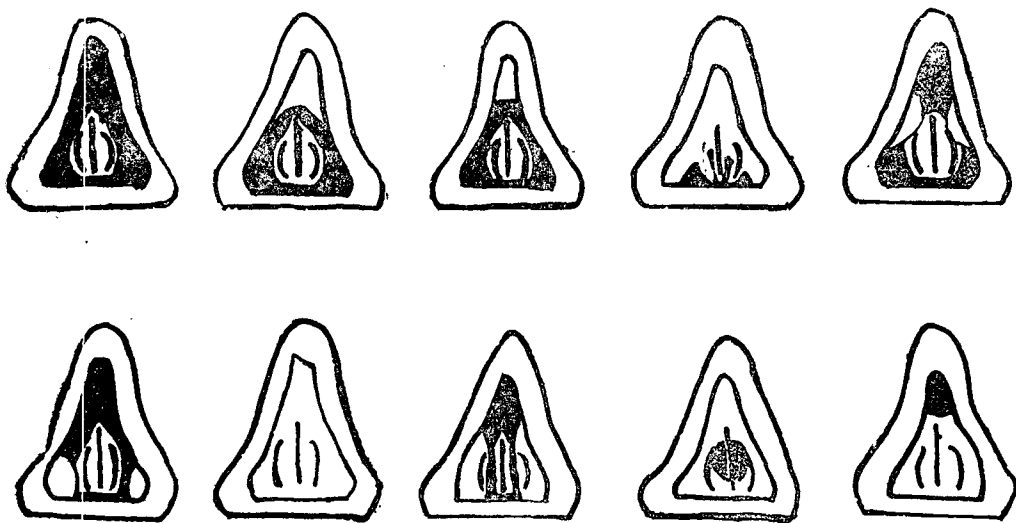


Fig 3. Surface views of unstained embryo.

**Table 1. Frequency of surface views of unstained embryo.**

type	I type	II "	III "	IV "	V "	VI "	VII "	XII "	IX "	X "	Total
1	59	41	36	23	18	2	16	3	2	0	200
2	66	43	28	20	17	2	11	10	1	2	200
3	67	45	37	17	16	0	3	15	0	0	200
4	58	38	34	25	14	3	15	9	1	3	200
5	59	43	38	24	12	1	7	13	1	2	200
Total	309	210	173	109	77	8	52	50	5	7	1000
%	30.9	21.0	17.3	10.9	7.7	0.8	5.2	5.0	0.5	0.7	100

As shown in Table 1, the frequency of appearance was relatively as high as 30.9% in I type (embryo completely and uniformly stained), 21.0% in II type (upper half of embryo unstained), 17.3% in III type (upper of embryo unstained), and 10.9% in IV type (lower of embryo stained), but as low as 0.5% to 7.7% in V type (median extremities of embryo unstained), in VI type (lower extremities of embryo unstained), in VII type embryo unstained in IIX type (me-

dian extremities and lower extremities of embryo unstained), in IX type (all parts except median of embryo unstained), and in X type (all parts except upper of embryo unstained).

As the results obtained above show, the frequency of appearance of II and III type, which showed the necrosis only in the plumule, was the highest at 38.4%; also, IV type, which showed the necrosis in the entire embryo except the radicle, was relatively high at 10.9%.

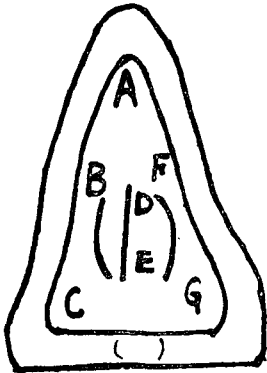


Fig. 4. Position of embryo investigated.

**Table 2. Frequency of positions of embryo unstained.**

position	A	B	C	D	E	F	G	Total
1	107	97	52	50	27	65	50	448
2	111	91	45	44	29	59	45	424
3	115	89	41	39	22	57	49	412
4	108	101	57	41	20	64	51	442
5	111	95	53	44	29	65	44	441
Total	552	473	248	218	127	310	239	2167
%	25.5	21.4	11.6	10.0	5.9	14.3	11.3	100

Fig. 4 shows the position of the embryo that was subdivided and investigated. As shown in Table 2, the frequency of appearance of the necrosis is the highest in A at 25.5% and also B, F, C and G are relatively high at 21.4, 14.3, 11.6 and 11.3%, respectively.

From the above results (Table 1, 2), it seems that the necrosis in the embryo occurs in the plumule first and develops into the radicle. It has been reported by Kondo(13) that necrosis in barley, wheat, rye, and oats occurs in the radicle first, and it has also been reported by Bulat(7) and Kim(11) that necrosis in Brassica

occurs in the radicle and necrosis in Raphanus occurs in the plumule first. This means, the author believes, that the appearance of necrosis in the embryo is associated with plant classification.

According to the standard of the Palmerston-North Method(10), the seeds of I, V, and VI type have a great germination capacity, and the germination rate of them was 39.4% in this experiment. This rate is higher by 2.4% than the 37% germination rate which was obtained by the general method carried out in the laboratory. Generally, it has been reported by in-

investigators (7) that the germination rate obtained by the T.T.C. method is not always the same as that obtained by the general method. B) The necrosis appearance in the inside of

the embryo. The phenomena of necrosis in the median longitudinal section are shown in Fig. 5 and the frequency of them is as shown in Fig. 6.

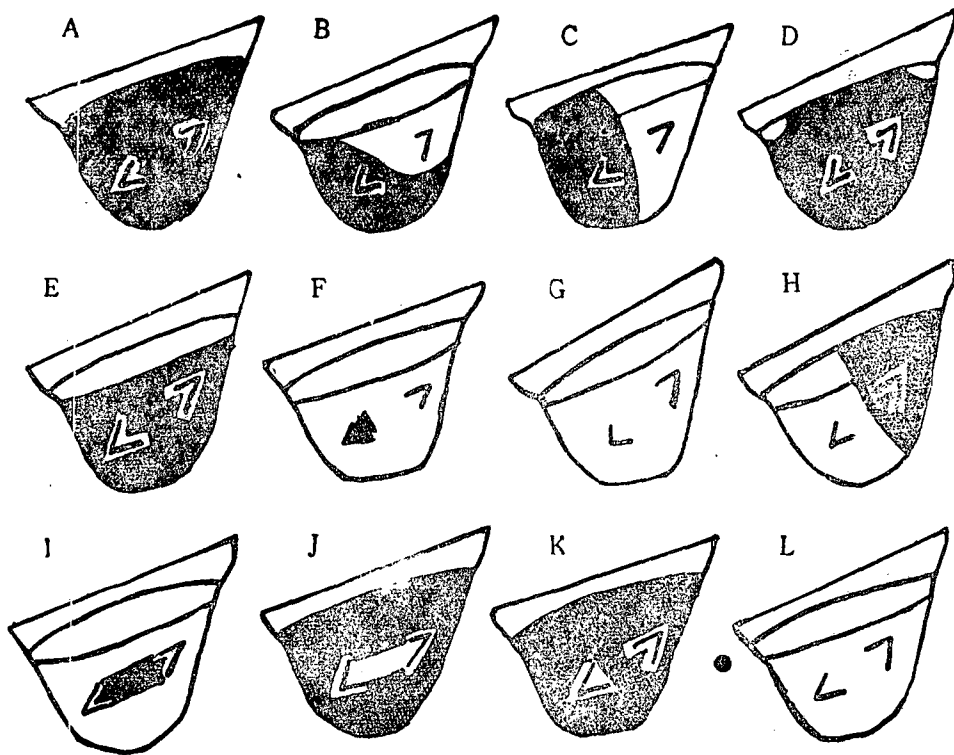


Fig. 5. Median longitudinal sections of embryo unstained.

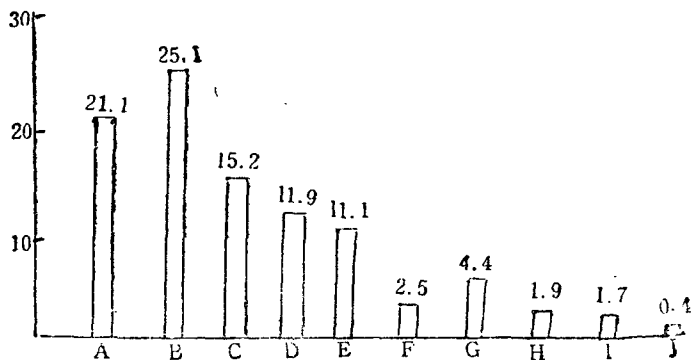


Fig. 6. Percentage of types of embryo unstained in Fig 5.

As shown in Fig. 6, the frequency of appearance of B type (scutellum and upper half of embryo unstained), A type (embryo completely and uniformly stained), C type (upper half of embryo unstained), D type (extremities of scutellum unstained), and E type (scutellum unstained) was as high as 25.1, 21.1, 15.2, 11.9 and 11.1%, respectively, but very low in the other types.

In the results obtained above, the

frequency of B and C type (Fig. 5) in which necrosis occurred only in the plumule was the highest at 40.3%. This means that necrosis occurs in the plumule first.

In the seeds where necrosis did not completely occur in the surface tissue of the embryo, necrosis of the inside tissue was not observed. But the frequency of the seeds (F type in Fig. 5) in which necrosis completely occurred in the surface tissue of the embryo and partially occurred in the inside tissue was 36% (Table 3).

Table 3. Frequency of A, G and F types.

	Number of embryo in the surface	%	Type of embryo unstained					
			A		G		F	
			No	%	No	%	No	%
All stained embryo	211	100	211	100	0	0	0	0
All unstained embryo	69	100	0	0	44	64	25	36

From the results obtained above, it seems that necrosis, in the embryo, occurs in the surface tissue first and develops into the inside tissue. Furthermore, it was only in F type (necrosis occurred in the plumule but not in the radicle) that necrosis completely occurred in the surface tissue but only partially occurred in the inside tissue. Therefore, it is believed that necrosis had occurred previously in the plumule. From this fact, too, it seems that necrosis occurs in the plumule first.

#### 4. SUMMARY

This experiment was designed to get some information on the parts in which necrosis occurs first in the embryo of rice, and on the phenomenon of necrosis that develops into other parts. Norin No. 6 harvested in 1967 was used for this experiment and necrosis appearance was investigated by the T. T. C. method.

The results obtained are summarized as follows:

ows:

- 1) Necrosis of the embryo in rice occurred in the plumule initially.
- 2) It was observed that the necrosis developed from the plumule to the radicle.
- 3) Finally, it was shown that necrosis developed from the surface tissue of the embryo to the inside tissue.

#### 摘 要

벼종자에 있어서 necrosis가 어떤 部位에 어떻게 發現 되는가를 알기 爲하여 1967年度産 農林六號 種子の 胚를 抽出하여 T. T. C. 方法에 依據 觀察調査한 結果는 다음과 같다.

- 1) 幼芽部位에서 necrosis現象이 처음 發生하였다.
- 2) 幼芽部位에서 幼根部位로 necrosis 現象이 점차 擴大되어 가는 것을 알수있었다.
- 3) 胚의 表面組織에서 内部組織으로 necrosis現象이 移行되어 감을 볼수있었다.

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