(3.2)

องค์ประกอบผลผลิตของข้าว

HIGHER PADDY YIELD VIEWED FROM YIELD COMPONENTS

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The figures in the column (a) of the Table 1 show the average paddy yield of the seven countries in 1965. The countries are arranged according to their location from the north to the south. It is clearly shown that the higher yield is obtained at the higher latitude. In 1963 and 1964, two kinds of experiment were conducted in these seven countries under the initiative of the International Rice Research Institute of the Philippines. The figures in the column (b) show the average yield obtained by the standard cultivation method in each country. The 4-tons per hectare yield level can be attained in any country by using the native varieties provided the water is well controlled and proper cultivation technique including fertilizer application is employed. The figures in the column (c) show the average yield by the intensive cultivation, that is, the native varieties were grown by the method which is considered to be the best at each locality. The differences among the countries observed in the column (a) vanish in the column (b) and appear again in the column (c). In other words, the yield increase in the lower latitude zone can not exceed 4 or 5 tons per hectare level. Based on these data, Dr. Tanaka concluded that the yield increase must be considered step by step, namely, from the column (a) level to the column (b) level and from (b) to (c) and finally from (c) to the still higher level.

In order to examine whether the concept of these yield levels can be applicable in Thailand, I have collected the various fertilizer experiment data available at the Department of Rice and reviewed them from this point of view. The followings are the conclusion thus obtained:

1. Although the average yield of the whole contry is somewhat between 1.5 and 2.0 tons/ha, the average of Changwat or Amphoe ranges from 0.8 to 2.5 tons/ha. This indicates that the native varieties can yield at least 2.5 tons/ha under the present cultivation method provided the water is sufficient and the natural soil fertility is high enough.

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2. The various fertilizer experiments conducted either in the experimental stations or in the farmers' fields, show that 2.5-3.0 tons/ha yield is almost always and anywhere attainable by the fertilizer application of which rate is usually 20-30 kg/ha. of nitrogen.
3. When higher dose of fertilizer, about 50 kg N/ha or more, is applied, 4.0-4.5 tons/ha, can be obtained. But this is not always obtained. The additional nutrient supply by fertilizer does not seem the sole condition for this level of yield. The variety, soil condition, proper plant protection, time and rate of fertilizer application etc must be properly chosen. The cultivation technique for this level of the yield could not be said to have been established.
4. Some varieties selected from the native varieties can sometimes yield 6-7 tons/ha. Although this indicates the great potential of the native varieties, much more works are to be done before such a high yield becomes practicable in the farmers' fields.

The analytical method of the yield is decomposed to the yield components, is one of the most important approach to understand the mechanism of the yield increase. I have made some investigation on the yield components of paddy rice of the different yield levels.

The yield component consists of the four major factors: number of panicles per unit area, number of spikelets per panicle, percentage of the filled grain and 1,000 weight when the yield is measured by weight.

Firstly, I made several field surveys in order to know the yield components of the common yield level in the farmers' field, that is, 1.5-2.0 tons/ha level. Table 2 shows the average values of yield components of four different surveys conducted by myself, with the assistance of the Technical Division of the Department of Rice, in comparison with those by Watabe. The average yields of the surveys exceed the average yield in that area by the statistical report by the government authority. This may be explained by the fact that the survey plot is usually selected from those fields which are not damaged by flood, drought, insects, diseases and so on. The average of the number or panicles per m^2 is usually between 90 and 110 panicles and that of per hill is around 8. The average of planting density is 12 hills/square metre. The average of the number of spikelets per panicle is quite different from one survey to another. This might be considered because of the different method of counting as well as the surveyed area itself. The fewer number of spikelets per panicle in 1966 and 1967 surveys might be explained as that the smaller and weaker panicles were equally counted. The most common number of spikelets per one normally grown panicle seems to be 130-150. The percentage of filled grain is 75-80% in most cases. One thousand grain weight is 26-27 grams for the non-glutinous varieties in the Central Plain and 30 grams or more for the glutinous varieties in the north. These figures stated above could be regarded as the most common yield componnents values of the paddy, grown in the farmers' fields under the favorable condition without severe damages.

Needless to say, these figures are the averages of 20-30 samples. When one looks at the figures of each plot, for example as show in Table 3 of the result of 1966 survey in the Central Plain, he may find the great variation from place to place. The most striking differences are those found in the planting density and the per-hill dry matter production. Fig. 1 was drawn by plotting 23 transplanted fields in the Central Plain on the graph with the planting density on the horizontal and the total dry weight per hill on the vertical axis. According to the position on this graph, the 23 samples can be classified into groups A, B and C. The average value by each group and the value for grouping can be seen in the Table 3 in the previous page. The significant differences among the averaged values by group are observed in most of the yield components. Therefore, this classification into these three groups is considered to be adequate for the better understanding of the growth types of the 23 samples.

The fields belonging to Group A are planted least densely but each hill has 11 panicles. As a result, number of panicles per unit area can be kept not so low level, namely 106. The number of spikelets per panicle of this group are superior to the other groups resulting the best average yield among the three groups. Group A can be regarded as one of the typical types of the high yield area with sufficient supply of water in the Central Plain. Group B has almost the same planting density but fewer panicles per hill, resulting in fewer number of panicles per square metre. namely only 91. Both of the number of spikelets and percentage of filled grain of this group are poorer than those of Group A. Thus Group B shows the lowest average yield among the three. This group seems to be the most common type in the low yield areas in the Central Plain. The characteristic of Group C is the extremely dense planting 148 panicles per m^2 but both of the spikelets number and percentage of filled grain are very poor. This offsets the greater number of panicles but the average yield is still better than Group B. Group C may represents those fields in the peripheral parts of the Central Plain where the rain water is sole source of water supply and the planting is often delayed owing to the lack of water. Thus, the transplanted rice in the Central Plain can be classified into three types according to their yield components pattern, and their distribution seems to be correlated to the sorrounding conditions of which most influential factors may be water supply and inherent soil fertility.

In 1967 the similar survey was conducted in the certain portion of the Central Plain as a case study, that is, the Saraburi-Ayuttaya area. The surveyed area consists of about 30 km x 30 km area in which 30 samples were collected. The result can be seen in Table 4. Such a broad diversity observed in the 1966 survey in the whole Central Plain is not seen in 1967 because the area is restricted to the much smaller portion. However, the yield in the 1967 survey shown in Table 4. ranges from 0.8 to 4 tons/ha. Similarly, numbes of panicles per square metre ranges from 42 to 167. The three types of yield components pattern recognized among the 23 samples in the 1966 survey might not appear clearly but one could easily see at least two types. One is the densely planted, has more panicles per unit area but fewer number of spikelets and the other one has the wider spacing, fewer panicles per unit area but larger number of spikelets per panicle. These two types can be found at any yield level. In other words, the higher or lower yield does not have the correlation with the types of yield components pattern.

The correlation study among the yield and its components is another interesting point of view which becomes possible by using the data obtained by this kind of survey. Table 5 shows the correlation coefficients obtained from the 23 samples in the Central Plain in 1966. Yield has the positive correlation with both of the number of panicles/unit area and the spikelets number per panicle. This positive correlation between the yield and the panicle number is observed also in the surveys in Chai Nat area and in the northern Thailand conducted by Watabe. The same kind of survey conducted in the northeast of Malaysia also show the same tendency. As I will show later, the yield increase by fertilizer application is almost entirely caused by the increase of panicles. These mean that generally speaking, the present low yield could be increased by increasing the panicle number per unit area. Panicles could be increased by increasing either planting density or per-hill number of panicles. But these two factors show the negative correlation in the 1966 survey. The closer spacing does not necessarily bring about the increase of the panicle number, especially when no fertilizer applied. The fertilizer application under the present rather wide spacing condition, may or may not increase the panicles significantly. This will be discussed later. In the 1966 survey, the correlation between yield and spikelets number per panicle was also shown significant though only at 5% level. The other yield components did not show the significant correlation with the yield. Total dry matter production showed the highest correlation with the yield. This means that at the present low yield level, the yield increase can be brought simply by trying to increase the total dry matter production.

In the 1967 survey in the Saraburi-Ayutthaya area, the correlation study shows a quite different result as shown in Table 5. First of all, the panicle number per unit area does not have the significant correlation with the yield. The yield shows the positive correlation with the spikelets number, percentage of filled grain and one thousand grain weight. And the number of panicles per unit area shows the significant correlation with the planting density and negative correlation with the spikelets number per panicle. These facts might be considered as follows: As the surveyed area is rather small compared with that of the 1966 survey, the varieties and the soil condition in the area are more or less similar, resulting in the rather constant number of panicles per hill. Therefore, the panicle number per unit area mainly depends on the planting density which seems to be much related to the planting time. In other words, where the water is not sufficient, the planting is delayed and the seedlings are planted densely. In such fields, the water supply is also inadequate at the later stage of growth, which lowers the spikelets number.

Apart from these yield components surveys in the farmers' fields, I have conducted several fertilizer experiments at the Rangsit Experimental Station since 1966. In 1967, two varieties, Pouang Nahk 16 and Khao Dawk Mali 105 were used. In all plots, 80 kg/ha each of P_20_5 and K_20 were applied and only nitrogen amount was changed. Two different spacings were compared. So this experiment is a correlation study of variety x spacing x rate and time of nitrogen, with the randomized split-split plot design or four replications. The results are summarized in the four graphs in the following pages.

The first graph (Fig 2) shows the yield and its components of Khao Dawk Mali variety planted at 30 x 30 cm spacing. The amount of nitrogen applied at the transplanting time is plotted along the horizontal axis from 0 to 90 kg N/ha. The vertical axis on the left shows the index of the yield and its components with the figure of no-nitrogen plot as 100. The scale of the index number on the vertical axis is the same in any graphs in the same or the other three figures. So that the relative importance of the fluctuation of each component to the yield can be easily understood. The black dots indicate those treatment which received only basal application of nitrogen while the white ones show those received both of the basal and 30 kg N/ha top dressing at the I.P.P. stage. For instance, look at the first graph at the upper left corner which shows the yield. Three black dots connected by line indicate the yield of 0,60 and 90 kg N/ha plots from the left to right. The first of the white dots above the black ones indicates the yield of the plot which received 30 kg N as basic and additional 30 kg N as top dressing, so total 60 kg N/ha is meant to be applied. The second white dot in the middle means the yield of the plot which received 60 kg N as basal and 30 kg as top dressing, total 90 kg N/ha.

The common phenomena observed in both varieties at either spacing are as follows:

1. If the nitrogen is applied at the transplanting time only, yield reaches its maximum at 60 kg N/ha. The yield level thus reached is around 3 tons for Khao Dawk Mali and 4.3 tons for Pouang Nahk.
2. The 30 kg N/ha applied as top dressing at I.P.P. stage has significant effect in any case regardless the amount of basal nitrogen. The yield reaches 3.6-4.0 tons in the case of Khao Dawk Mali and 5.6-5.8 tons in the case of Poung Nahk.
3. Number of panicles per square metre shows the similar pattern in any case, particularly when only basal nitrogen was applied. The maximum for Khao Dawk Mali is 150-170 and that for Poung Nahk is 160-190, The effect of top dressing on the panicle number is less significant.
4. The spikelets number per panicle neither increases nor decreases significantly by increased amount of the basal nitrogen and thus increased panicle number, When decreased, if any the extent is much smaller than that of the increase in the panicle number and furthermore the decrease which would be caused by higher dose of basal nitrogen can always be avoided by top dressing, The effect of top dressing on the spikelets number per panicle seems more clearly show at the higher dose of basal nitrogen.
5. Both of the percentage of filled grain and 1,000 grain weight show negligible fluctuation compared with those of the other components.
6. Consequently, the spikelets number per unit area shows almost the identical pattern as the yield itself.
7. Total dry matter production continues to increase at higher level of basal nitrogen application. This results in the lower grain/straw ratio.

Secondarily the varietal differences are summarized as below:

1. The yield of Pouang Nahk is 1–1.5 tons higher than that of Khao Dawk Mali at any rate of basal N without top dressing.
2. This difference in yield is mainly caused by the smaller panicle of Khao Dawk Mali whose spikelets number is less than 100.
3. When planted closely at 3 x 15 cm. Pouang Nahk can yield more number of panicles while Khao Dawk Mali yields more or less the same panicles as the wider spacing.

Thirdly, the effect of spacing will be summarized as follows:

1. The close spacing does not cause any significant difference not only in the yield itself but also in any other yield components in the case of Khao Dawk Mali.
2. When Pouang Nahk is planted at closer spacing, the panicle number increases to some extent but the spikelets number per panicle decreases to the same extent. Thus the yield itself is not affected by spacing.

The result of the fertilizer experiment in 1967 will be summarized as below: when the nitrogen is applied as basal fertilizer together with proper amount of phosphorus and potassium, the yield increases. This increase is almost parallel to the increase of panicle number as well as the total dry matfer production, and does not cause any significant decrease in the spikelets number, percentage of filled grain and 1,000 grain weight. However, thus increased yield soon reaches its maximum, of which level differs according to the varietal characteristics. The effect of top dressing at the I.P.P. stage is significant even at this yield level. When the amount of basal nitogen increases, it causes only the increase in total dry matter production but not in grain yield. This is mainly because the panicle number does not increase any more. At this yield level, the further yield increase can be attained only by top dressing which increases the spikelets number significantly. For most of the native varieties, the first yield level which can surely be reached by a limited amount of basal nitrogen, seems to be around 3.0 tons/ha which approximately coincides with the average yield of Changwat or Amphoe in the high yield area as well as with the yield level attainable by any varieties at any place as shown in the various fertilizer experiments either in the station or in the cultivators' fields. The second yield level, around 4.0 tons/ha which can be attained also by most of the native varieties but only in the favorable soil and water condition or by proper time and rate of nitrogen application including top dressing, might have such a yield composition in which the panicle number as well as spikelets number reach their maximum. The higher than this yield level can be attained only by certain varieties which can yield at least 180-200 panicles per square metre and still can hold big panicles.

The spikelets number can be rather easily improved by top dressing as shown in the experiment. But the further increase by fertilizer can not be expected because it is limited by the varietal characteristic. However, the panicle number will be possiblly increased further. The next figure (Fig 6) shows the number of tillers at successive growth stages. Khao Dawk Mali has the ability to hold 300–400 tillers/m^2 at the certain growth stage. However, it decreases sharply during the so-called "Vegetative log phase" between the maximum tiller number stage and the I.P.P. stage. The number of tillers remaining at the I.P.P. or flowering stage is only slightly more than the final panicle number. As one hill consists of three seedlings at the transplanting time, the initial number is 33.3 and 66.7 plants per square metre at 30 × 30 and 30 × 15 cm spacing, respectively. Therefore, 200 panicles at the harvesting time means that individual plant has only six when planted 30 cm apart or merely three panicles when planted 30 x 15 cm apart. The poor tillering ability of the tropical varieties seems to be caused by the setback of younger tillerings rather than the tillering ability itself. How to overcome this bottle neck might be one of the break-through for the higher yield.

Table 1 Comparison of Average Yield and Yields of Standard and Intensive Cultivation Among Countries

	Average Yield	Standard Cultivation	Intensive Cultivation
	(a)	(b)	(c)
Japan	4.85	4.77	7.82 tons/ha
Taiwan	3.58	4.77	6.47
Thailand	1.50	4.27	—
Philippines	1.23	4.29	4.61
			(6.31) (d)
Malaya	2.37	3.45	3.41
Indonesia	1.82	3.93	—
Australia	6.06	—	9.47

(a) Rice Journal 68 (2): 42 (1965)

(b) 40 kg/ha each of N, P_2O_5, and K_2O applied to native variety planted at the spacing of 30cm. × 30cm. The figures show averaged yields of 31 experiments at 11 locations in seven countries in 1963.

(c) Conducted at the same locations as (b) in 1964 by employing the native variety and cultivation method thought to be most appropriate at each locality.

(d) Yeild by Taichun Native 1 and Tainan 3

Source: TANAKA, A., "Rice Cultivation in Southeast Asia and Its Problems", *Logic and Direction of Progress in Rice Cultivation Technique*, Institute of Agricultural Science, Tohoku University (editor), 1966 (in Japanese)

Table 2 Comparison of Results of Yield Components Surveys in Thailand

	Yield tons/ ha	Panicles /sq.m.	Panicles /Hill	Hills /sq.m.	Spikelets /Panicle	Percent Filled Grains	1,000 Grain Wt.grm.
23 Samples in the Central Plain, 1966*							
max.	5.13	192	17.7	32.0	244	90.1	35.1
min.	0.99	68	5.0	6.2	40	61.3	23.2
mean	2.33	108	8.2	14.4	104	77.6	27.7
30 Samples in Saraburi-Ayuttha ya Area, 1967**							
max.	3.95	167	15.90	18.5	166	93.4	33.5
min.	0.77	42	5.22	4.8	43	56.8	21.3
mean	2.09	95	8.18	11.9	106	78.1	27.8
29 Samples in Saraburi-Ayuttha ya Area, 1968***							
max.	3.31	150	11.75	18.3	236	92.4	33.3
min.	1.43	47	4.61	7.3	46	70.2	20.6
mean	2.43	89	7.77	11.9	129	84.1	25.4
17 Samples of High Yield Areas 1968**							
max.	5.57	228	14.67	25.0	203	94.7	35.2
min.	2.22	74	4.47	6.3	84	78.3	20.2
mean	3.50	120	9.57	13.5	153	89.2	25.8
12 Samples in Chai Nat Area 1963***							
max.	3.51	128	14.2	19.0	(247)1/	89.6	35.0
min.	0.13	46	3.2	7.4	(136)	68.1	27.5
mean	1.53	79	7.5	12.1	(183)	80.4	30.0
11 Samples of Single Cropping Fields in Northern Thailand, 1965****							
max.	3.62	165	12.3	15.4	221	82.8	40.5
min.	1.00	41	3.9	8.8	62	65.4	30.4
mean	2.72	87	7.2	12.0	150	73.4	35.8
14 Samples of Double Cropping Fields in Northern Thailand, 1965****							
max.	4.55	123	19.3	11.3	211	86.4	40.2
min.	2.01	60	6.5	4.5	145	62.5	29.4
mean	3.28	90	11.2	8.4	176	77.2	34.1

1/ Number of Grains per Panicle

Sources:* FUKUI. H., *Rice Culture in Central Plain Thailand*, I. Back Ground and the Results of Yield Components Survey, 1966. (mimeo.)

Table 3 Yield Components Survey in the Central Plain, 1966

No.	GROUP	Paddy Yield gr/m²	No.of Panicles /m²	No.of Panicles /Hills	No.of Hills /m²	No.of Spikelets /Panicle	Percent Filled Grain	1,000 Grain Weight	Total Dry wt. gr/m²	Grain /Straw Ratio	Plant Height cm	
5	A	145	68	11.0	6.2	88	81.8	29.5	585	0.40	163	
7	A	228	86	9.0	9.6	114	83.6	27.9	856	0.41	191	
8	A	325	70	8.7	8.1	244	79.5	23.8	944	0.75	187	
15	A	513	157	10.7	14.7	129	85.0	29.7	1,404	0.49	153	
18	A	334	107	9.7	11.0	117	87.4	30.7	1,321	0.45	208	
22	A	260	152	17.7	8.6	86	77.2	25.7	1,038	0.45	154	
23	A	245	105	9.0	11.7	90	90.1	28.5	1,169	0.31	200	
mean		293	106	10.8	10.0	124	83.5	28.0	1,045	0.47		
1	B	169	74	6.3	11.8	170	64.3	20.9	510	0.66	142	
2	B	156	96	11.3	8.5	76	76.2	28.1	556	0.48	143	
4	B	99	71	6.3	11.2	75	70.6	26.4	395	0.47	138	
9	B	173	101	7.0	14.4	40	85.5	35.1	514	0.68	144	
11	B	148	123	11.0	11.2	75	69.0	23.2	581	0.46	103	
16	B	127	76	6.3	12.0	83	77.8	26.2	446	0.50	115	
17	B	265	116	8.7	13.3	114	72.4	27.7	588	0.81	134	
19	B	287	90	7.3	12.3	130	78.7	31.3	766	0.79	161	
24	B	206	81	7.3	11.1	130	72.6	27.0	617	0.62	152	
25	B	194	86	5.7	15.0	96	84.1	27.9	572	0.66	139	
26	B	192	87	7.1	12.3	105	82.5	25.3	738	0.60	142	
mean		183	91	7.7	12.1	99	75.8	27.2	571	0.61		
10	C	237	124	5.0	24.7	73	80.3	33.1	736	0.52	137	
12	C	309	154	6.3	24.5	136	61.3	23.9	835	0.79	148	
13	C	185	144	6.0	24.0	58	75.2	29.4	540	0.73	123	
14	C	384	192	6.0	32.0	90	76.6	28.9	1,030	0.73	141	
21	C	186	125	5.3	22.5	79	72.9	26.0	644	0.71	139	
mean		260	148	5.7	25.7	87	73.3	28.3	757	0.70	-	
F		3.98 **	8.07**	8.58**	6.60**	0.13	4.84**	0.22	12.97**	5.46*	-	
LSD 0.05		92	29	2.4	2.8	46	6.8	3.7	211	0.14	-	

Source: FUKUI, H., In press

Table 4 Yield and Yield Components of 30 Samples in the Saraburi–Ayutthaya Area, 1967

Location Number	Yield gr/m^2	No. of Panicles $/m^2$	No. of Hills $/m^2$	No. of Panicles /Hill	No. of Spikelets /Panicle	No. of Spikelets $/m^2 x10^2$	Percent Filled Grain	1,000 Grain wt. gr.	Total Dry wt. gr/m^2	Panicle Straw Ratio	Height cm	Water Supply*	Chemical Fertilizer** N Kg/ha	Chemical Fertilizer** P205/ha
N - 24	394.7	98	11.5	8.48	158	154	83.7	30.7	1218	0.56	185	5	15	19
N - 28	337.8	102	16.3	6.26	140	143	87.9	27.0	1017	0.55	178	4	0	0
N - 1	319.8	167	16.3	10.29	61	102	93.4	33.5	912	0.57	146	4	7	9
H - 15	318.6	102	12.8	7.96	133	135	78.8	30.0	807	0.76	152	3	23	29
H - 1	309.6	129	13.3	9.72	97	125	85.5	28.9	-	-	142	3	15	19
N - 8	268.2	105	14.3	7.33	130	136	73.5	26.9	614	0.91	159	3	10	13
N - 10	245.8	95	11.8	8.06	125	118	72.9	28.5	639	0.76	151	3	5	6
N - 31	239.0	80	9.0	8.92	124	99	87.4	27.5	-	-	-	3	9	11
H - 21	238.0	84	5.3	15.90	132	110	83.4	26.0	705	0.63	182	3	0	0
N - 15	230.0	113	10.8	10.49	103	116	70.1	28.2	735	0.53	181	3	8	10
H - 4	226.9	95	8.8	10.80	111	104	80.1	27.1	480	1.06	143	3	11	14
N - 22	226.5	118	15.0	7.83	85	100	80.9	28.1	561	0.76	128	2	7	9
N - 9	224.9	62	9.3	6.68	166	102	79.0	27.8	613	0.67	187	4	0	0
N - 23	221.0	135	18.5	7.28	76	103	76.6	28.1	601	0.70	125	2	17	21
H - 19	212.2	112	11.8	9.51	89	100	77.7	27.4	624	0.59	158	3	15	19
N - 14	202.0	74	11.3	6.53	127	94	77.1	27.9	491	0.80	155	2	-	-
N - 32	201.0	69	9.0	7.61	114	78	83.1	30.8	631	0.52	176	3	0	0
N - 6	177.5	158	17.8	8.89	43	68	86.9	29.8	433	0.74	114	3	0	0
H - 17	176.2	42	4.8	8.74	174	72	85.1	28.7	769	0.32	200	4	0	0
H - 20	175.6	81	12.3	6.63	97	79	80.3	27.8	489	0.68	162	2	13	16
N - 27	170.0	114	14.3	8.02	66	76	82.6	27.1	630	0.41	138	4	25	31
N - 26	168.7	79	9.8	8.10	94	74	80.1	28.5	545	0.54	174	3	13	16
N - 11	168.0	57	7.5	7.60	135	77	80.5	27.2	506	0.55	166	3	11	14
N - 5	147.6	111	13.0	8.56	93	104	58.7	24.2	490	0.56	-	1	0	0
N - 21	142.8	51	8.5	6.03	123	63	81.7	27.8	396	0.66	162	3	8	10
H - 13	139.4	77	11.8	6.53	82	63	80.2	27.6	425	0.60	154	3	0	0
N - 30	111.5	92	15.0	6.13	69	64	68.5	25.6	383	0.57	131	3	17	21
N - 13	104.8	60	11.5	5.22	93	56	72.2	26.1	258	0.87	134	1	-	-
H - 6	89.4	74	10.5	7.07	79	59	56.8	27.0	336	0.50	128	2	0	0
N - 25	76.8	118	14.3	8.26	53	63	57.6	21.3	286	0.49	103	1	-	-
mean	208.81	95.1	11.87	8.18	105.7	94.6	78.08	27.77	592.6	0.638	154.1	2.9	8.5	10.6
max.	394.7	167	18.5	10.80	174	154	93.4	33.5	1218	1.06	200	5	25	31
min.	76.8	42	4.8	5.22	43	56	56.8	21.3	258	0.32	103	1	0	0
s.d.(s)	75.84	29.7	3.34	2.01	33.1	27.1	8.79	2.13	215.4	0.157	23.9	-	-	-
c.v. (%)	36.3	31.2	28.1	24.6	31.3	28.7	11.3	7.7	36.4	24.6	15.5	-	-	-

*grade 5 : very deep, 1 metre or more, 4 : deep, 3 : normal, 2 : shallow, 1 : drought

**Ammo-Phos (16-20-0)

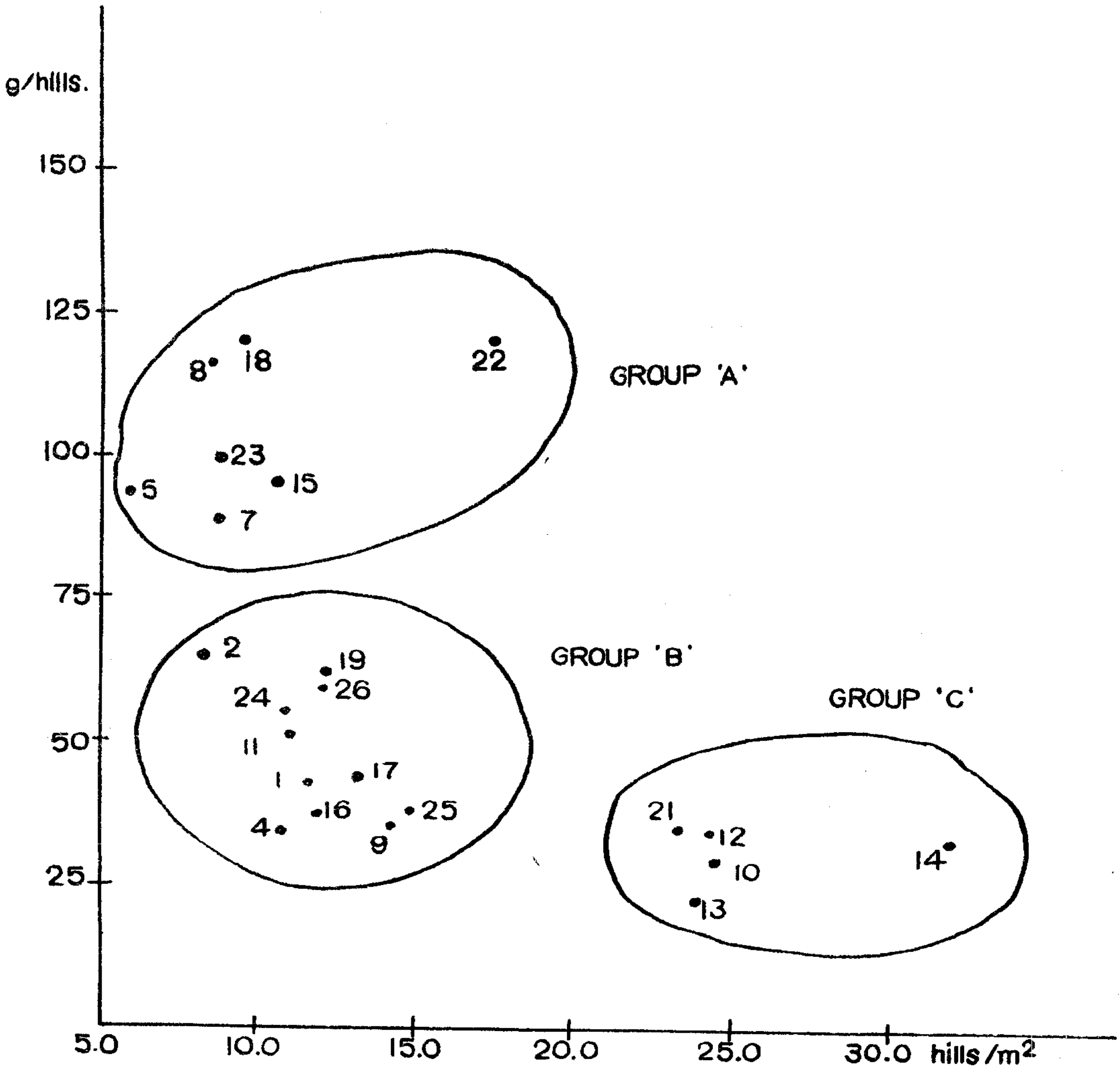


Fig. 1 Relation Between No. of Hills/m^2 and Dry Weight/Hill Among 23 Samples from Transplanted Fields

Table 5 Correlation Coefficients between Yield Components (23 Transplanted Fields in Central Plain)

	n–23
Yield – No. Panicles/m^2	0.575**
Yield – No. Panicles/Hill	0.047
Yield – No. Hills/m*	0.271
No. Panicles/Hill – No. Hills/m*	–0.569**
Yield – No. Spikelets/Panicle	0.423*
No. Spikelets/Panicle – No. Panicle/m^2	0.261
No. Spikelets/Panicle – No. Panicle/Hill	0.012
No. Spikelets/Panicle – No. Hills/m^2	0.250
Yield – Percent Fertile Grain	0.236
Yield – 1,000 Grain Weight	0.173
Yield – Total Dry Weight/m^2	0.854**
Yield – Panicle/Straw Ratio	0.175
Yield – Plant Height	0.389

** Significant at 1 Percent Level
* Significant at 5 Percent Level

Table 6 Correlation Coefficients (r) Among Yield and Its Components, Saraburi–Ayutthaya Area in 1967

(B)	(C)	(D)	(E)	(F)	(G)	(H)	
0.350	0.147	0.305	0.439*	0.587**	0.601**	0.911**	(A)
	0.790**	0.305	–0.619**	0.097	–0.252	0.224	(B)
		–0.294	–0.628**	–0.058	0.052	0.029	(C)
			0.027	0.211	0.078	0.299	(D)
				0.262	0.160	0.493**	(E)
					0.691**	0.546**	(F)
						0.568**	(G)

* Significant at 5%
** Significant at 1%

(A) Paddy Yield/sq.m.
(B) No. of Panicles/sq.m.
(C) No. of Hills/sq.m.
(D) No. of Panicles/Hill
(E) No. of Spikelets/Panicle
(F) Percentage of Filled Grain
(G) 1,000 Grain Weight
(H) Total Dry Matter Production/sq.m.
Source: Fukui, H., unpublished

Fig. 2 Khao Dawk mali 105, 30cm × 30 cm. (1967)

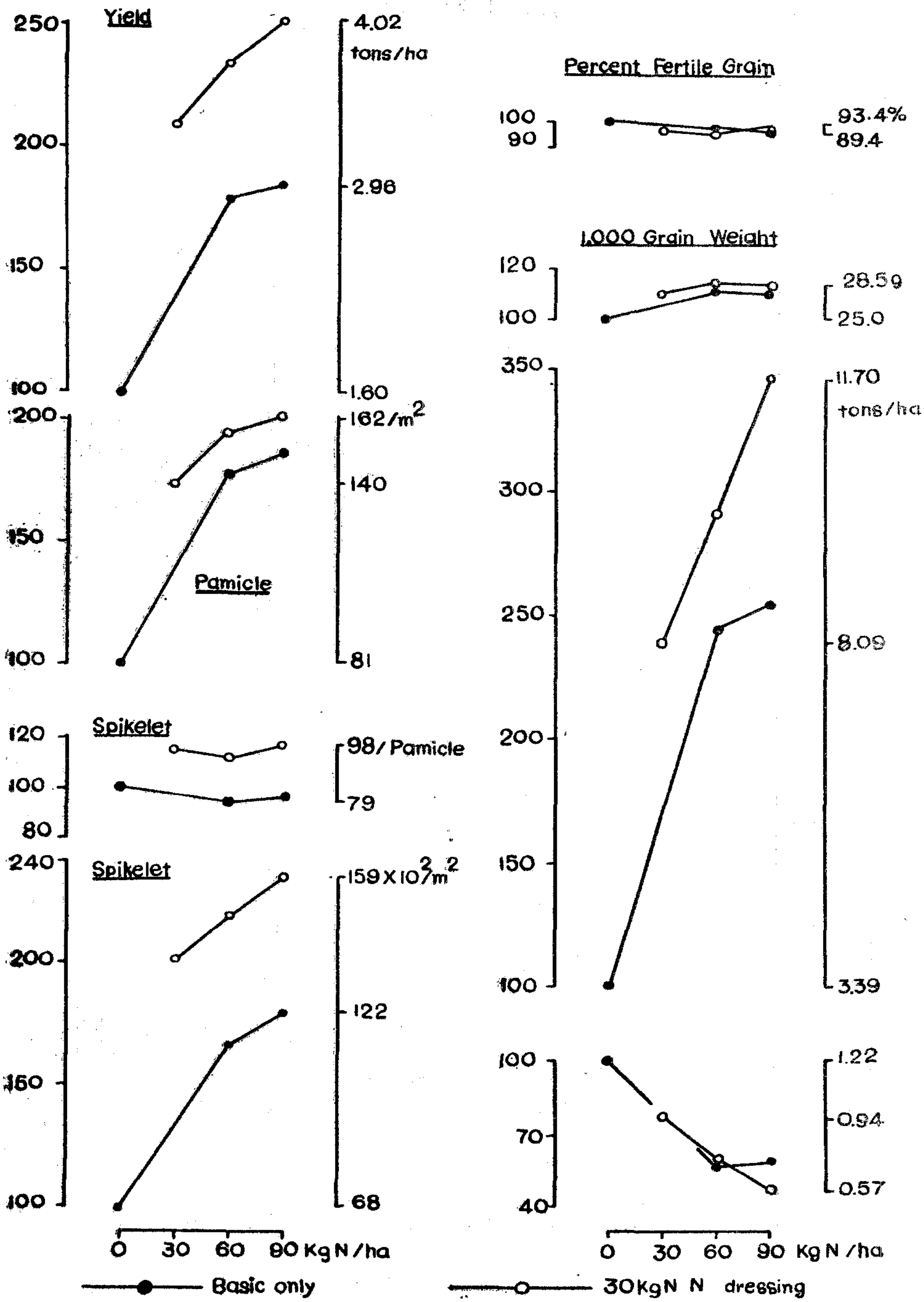
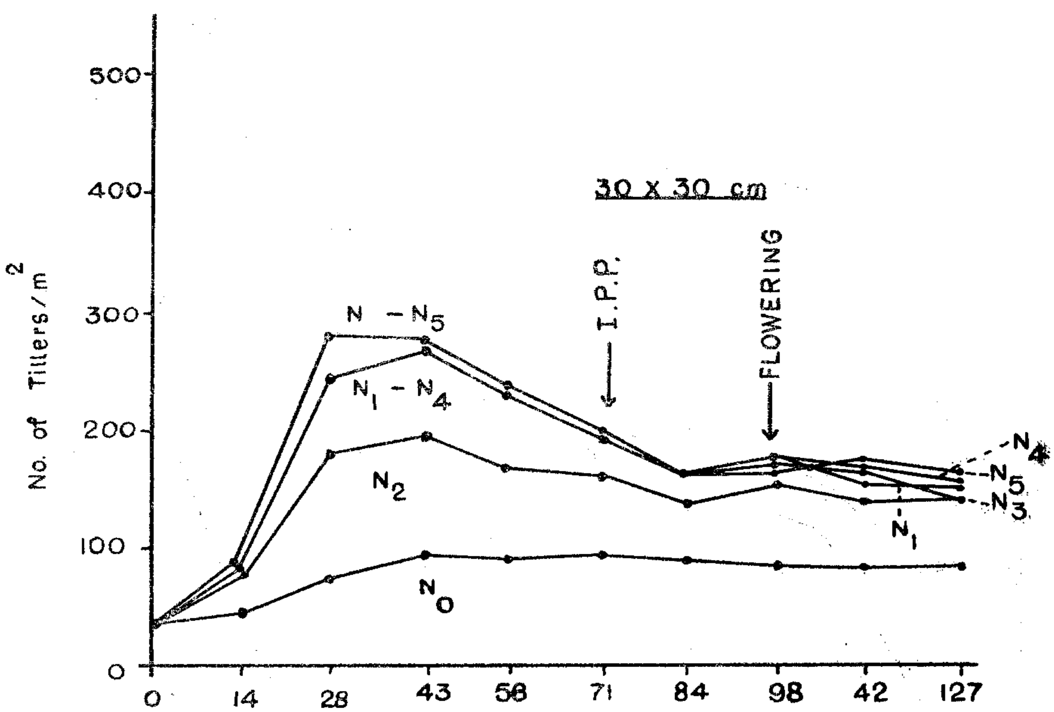
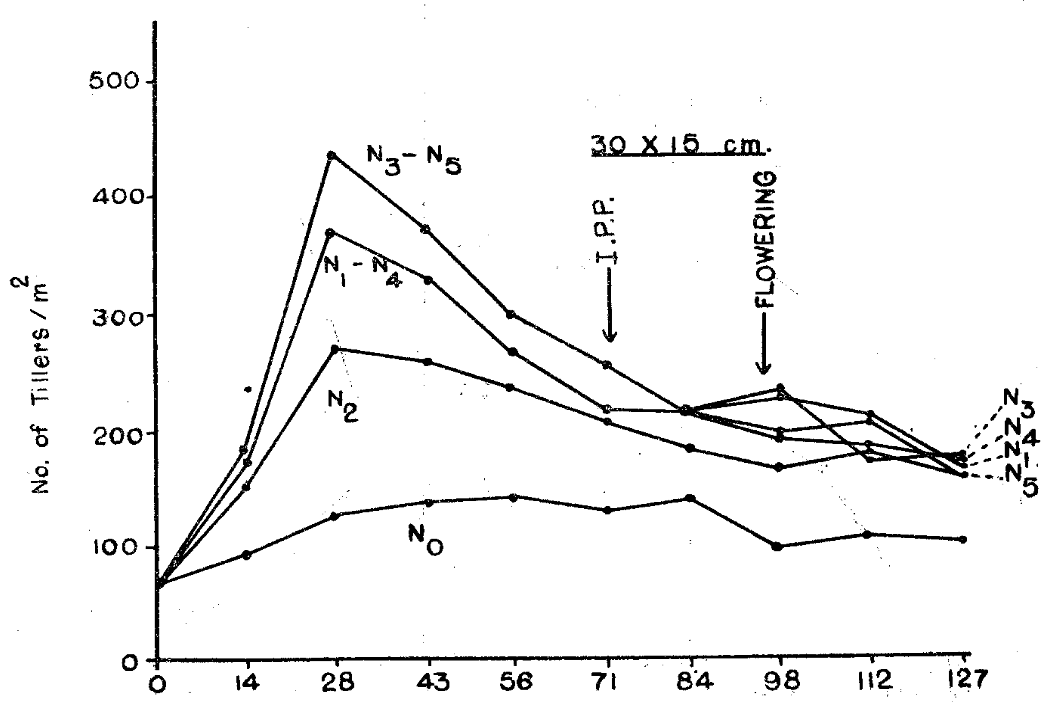


Fig. 3 No. Tillers/m² 1967 Khaos Dawk Mali 105





Days Aftes Transplanting

Fig. 4 Khao Dawk 105, 30cm × 15cm, 1967

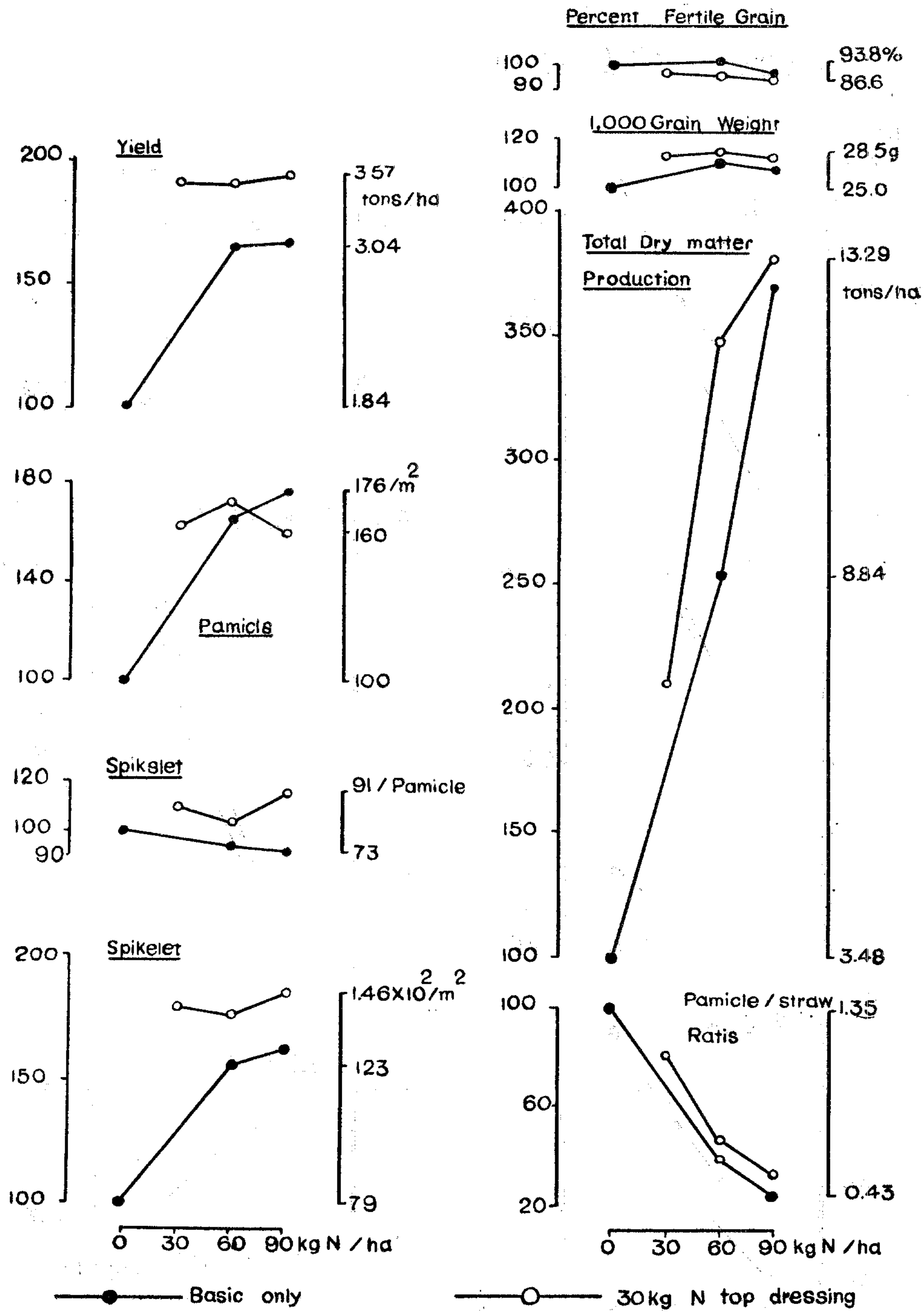


Fig. 5

Pouang Nahk 16 30cm X 30cm 1967

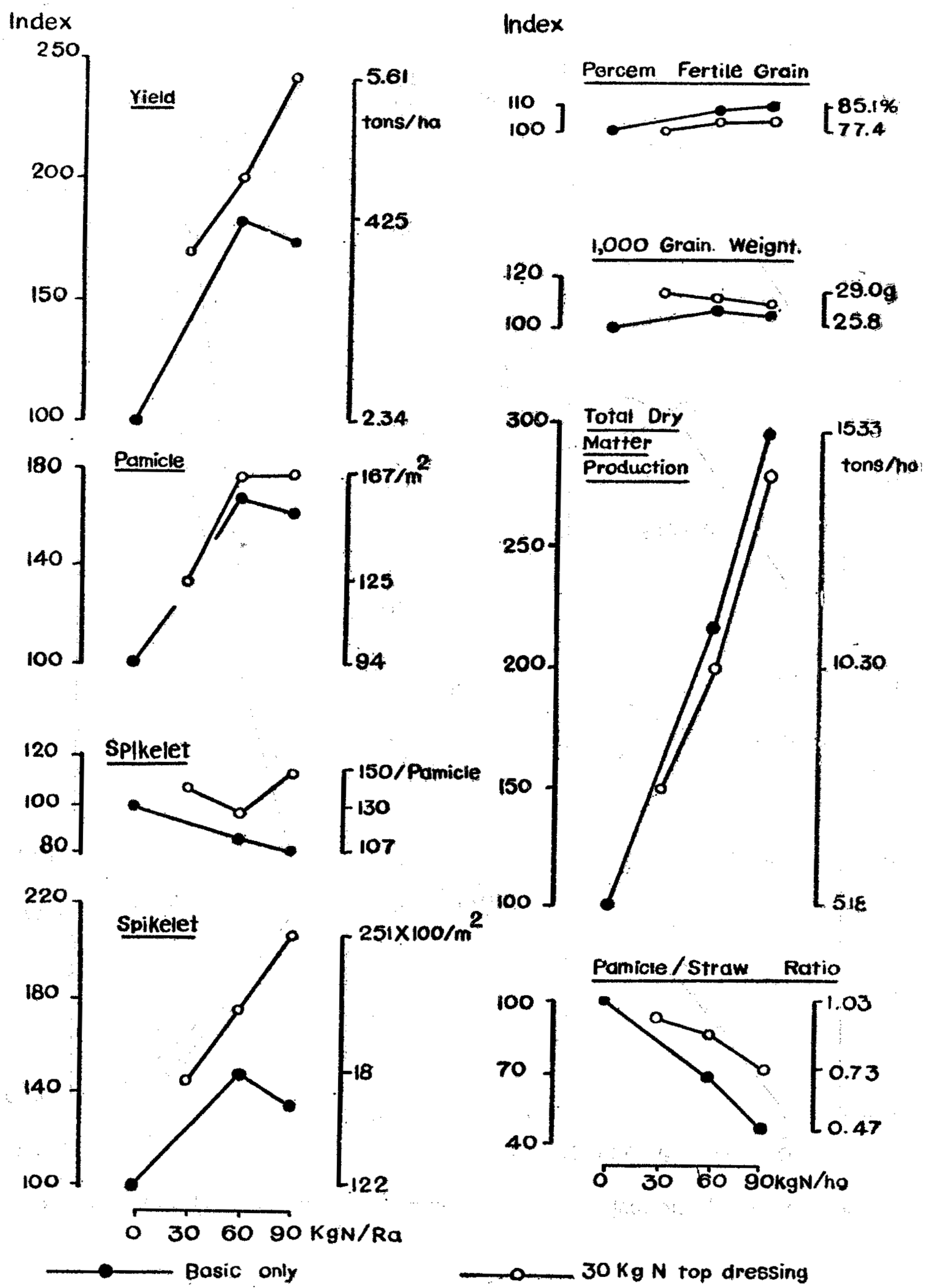


Fig. 6

Pouang Nahk 16. 30 cm x 15 cm , 1967