อิทธิพลของปุ๋ยที่มีต่อผลผลิตของข้าวโพดกัวเตมาลา

Response of Guatemala Corn to Fertilization[1]

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Expansion of corn production of Thailand, in the past, has been largely through the opening of new land for cultivation. Now that new land is becoming limited, and the demand for corn in the Asian market is increasing steadily, the additional increase of national corn production will depend on the improvement of soil fertility or fertilization, corn varieties and other farm practices.

Corn fertilization in Thailand is not a common practice among the corn growers. Eventhough many of them have heard that the use of fertilizers could bring up the yield, farmers still hesitate to use fertilizers on their corn. This may be explained by the fact that there is no clear evidences from experimental results to assure them as to how much responses of corn to fertilization could be obtained agronomically as well as economically, at different fertility levels of soils.

It is the objectives of this paper to present some data obtained on the various aspects of the response of corn to fertilization and the economical returns from fertilizer usage, based on field trials during 1962 and 1963.

MATERIALS AND METHODS

In 1962 four field trials were established. The experiments were designed to determine the effect of nitrogen, phosphate and potash fertilizers on the response of corn grown on soils of different fertility levels. Locations for the field trials were selected on the basis of differences in the soil test values. Three of the experiments were $4\times4\times3$ and the other was $3\times4\times3$ factorial of N, P_2O and K_2O respectively. The design of experiments was randomized complete block with three replications.

In 1963 six experiments were established in different farmers' fields. They were 5×4 factorial of nitrogen and phosphate. The effect of potash fertilizer was not studied this year and therefore maintained at constant level in all treatment combinations. The design of the experiment was the same

1 This paper has been presented at the First Inter - Asian Corn Improvement Workshop, Oct. 24-28, 1964 Kasetsart University.

except with 4 replications.

In both years, urea (46% total N), double superphospate (40% available P_2O_5) and muriate of potash (60%water soluble K_2O) were used as sources of N, P_2O_5 and K_2O respectively.

Guatemala, an open pollinated flint corn, was used as the indicator crop. Corn was planted in hills 50cm. apart and 100 cm. between rows. Three corn plants were left in each hill. This amounted to a population of 9,600 plants per rai (60,000 per hectare).

RESULTS AND DISCUSSION

I. Effect of fertilizer on yield of grain.

Results of the year 1962 indicated marked response of corn to fertilization. Fertilizers increased yield of grain even in the newly cleared land. Data indicated significant response of corn to fertilizer treatment in all locations. Response to fertilization were due primarily to the effect of nitrogen and followed closely by the effect of phosphate fertilizers. Response of corn to potash fertilizer was not obtained at any locations even in locations where the fertility of the soil was quite low. This would indicate that the natural level of available potassium in most soils is still sufficient for high yields of Guatemala corn. The illustration of the individual effect of nitrogen, phosphate and potash fertilizer upon yield of Guatemala corn is shown in Figure 1. It should be noted that, on the average, the highest yields of Guatemala corn in the low fertility soils would need an application of at least 16 kg. of N and 8 kg. of P_2O_5 per rai. Potash fertilizer may be omitted or applied at rates no higher than 8 kg. of K_2O per rai.

The yield response of corn to various combinations of N, P_2O_5 and K_2O are presented in Table 1. Data indicate that locations where soil fertility was relativaly low, namely at Tapra and at Prabuddhabat Agr. Exp. Sta., without fertilization corn produced only 249 and 236 kg. of grain per rai (1556 kg. and 1644 kg. per hectare). Soils of these locations have been cultivated continuously for more than 10 years. The natural fertility is, consequently, depleted and without the application of fertilizers the soils are unproductive for most crops, especially for corn. At Tapra and Prabuddhabat Agr. Exp. Sta., the maximum yields obtained from fertilization were 657 and 701 kg. of grain per rai (4104 kg. and 4362 kg. per hectare) respectively. The percent maximum yield increase due to fertilizers was 164 for the former and 196 for the latter location.

In 1963 highly significant response of corn to fertilizer treatments were obtained from all locations. The individual effect of nitrogen and phosphorus is also indicated in the same Table. In general nitrogen is still the primary limiting factor for high yields of Guatemala corn in all soils. The data also indicate that many soils are deficient in phosphorus. The individual effects of nitrogen and phosphate fertilizers upon the yield of grain are illustrated

in Figure 2. The maximum yield of corn at most locations was reached at 16 to 24 kg. of N per rai. The highest level of N (32 kg. of N/rai) did not increase nor depress the yield in all locations except at the Prabuddhabat Agr. Exp. Sta. where the application of nitrogen at 32 kg. of N/rai tend to depress yield. The low (10 kg. of P_2O_5/rai) to medium (20 kg. of P_2O_5/rai) level of phosphate fertilizer resulted in the maximum yield of grain at all locations. The highest level of phosphate fertilizer (30 kg. of P_2O_2/rai) gave no further increase in yield.

The yield responses of Guatemala corn to the application of various combinations of nitrogen and phosphate fertilizers of different locations are presented in Table 2. Percent maximum yield increase due to fertilizer treatment in 1963 varied from 29.8 to 138.9%.

The net return profit from fertilization was calculated by subtracting the cost of fertilizer from the value of grain produced on the fertilized plots. The value of grain obtained on unfertilized plot was also determined and the difference between the two treatments was the net return profit due to fertilizers.

The value of grain was calculated at an average price of 0.75 bahts[1]/kg. The cost of fertilizers were determined when urea, double superphosphate and muriate of potash cost 2.20, 1.80 and 1.55 bahts/kg. respectively. The net return profits resulting from fertilizer applications in the year 1962 and 1963 trials are shown in Tables 3 and 4. From these data it was realized that, treatments that gave the most economical yield return were not the same as those which resulted in the maximum yield. The most economical fertilizer treatments consisted of low to medium levels of N (8 to 16 kg. of N/rai) and low phosphate levels (8–10 kg. of P_2O_5 /rai) and low potash levels not exceeding 8 kg. of K_2O/rai. For instance treatments 8-8-0 resulted in relatively high economical yield return in two locations in 1962 and five out of six locations gave bast economical return with either 8-10-8 or 16-10-8 in the 1963 experiment.

II. Effect of fertilizers on yield of corn stover.

The yield of corn stover tends to increase with increasing fertilizer treatments. This is not surprising as corn which is well supplied with nutrients and producing higher yield will need a larger stalk. It was found that as the yield of grain increased the yield of stover also increased. In general appropriate featilizer treatments tend to increase grain more than stover. When individual effect of N, P and K upon the ratio of grain to stover were determined (Table 5), nitrogen fertilizers tend to affect grain to stover ratio more than phosphate fertilizer. As the amount of nitrogen increases the ratio of grain to stover tend to be wider at all locations. For instance the result from 1963 of one location, the plot receiving no nitrogen, regardless of the amounts of phosphate and potash fer-

1 The value of one baht is approximately 5 U.S. cents.

tilizers applied, one kilogram of stover produced 0.89 kilogram of grain. At the highest nitrogen rate (32 kg./rai) one kilogram of stover produced 1.07 kilograms of grain.

Applications of phosphate fertilizer, regardless of the amounts of nitrogen and potash applied, also widen the ratio of grain to stover at many locations. Potash fertilizer, as indicated by the 1962 results, however, tend to increase stover more than grain in all locations. For instance on the plot receiving no potash fertilizer, one kilogram of stover produced 0.73 kilogram of grain where as on the plot receiving 16 kilograms of potash per rai, one kilogram of stover produced only 0.67 kilogram of grain.

III. Effect of fertilizers upon number of ears per stalk.

The influence of fertilizers upon the number of ears per stalk of corn was studied during the 1962 and 1963 experiments. The data was obtained by counting all the seed bearing ears in the harvested plot; an average per single stalk was then determined by dividing the total number of ears by the total number of stalks in the harvested area. Two locations from 1962 and three locations from 1963 results indicated highly significant influence of the fertilizer treatments upon the stem bearingness of corn.

From data obtained it is realized that corn planted three stalks per hill with one meter between rows and fifty centimeters between hills in the row, produced an average of one ear per stalk only when sufficient fertilizer was applied. However without fertilizer or with insufficient fertilizers, under the same planting conditions only two stalks out of three in each hill, produced ears.

Therefore it may be concluded that under the natural fertility level of most soils the common practice of planting three corn stalks per hill would be too many for each plant in the hill to grow normally. The plants suffer from insufficient light and nutrients, consequently under these competitive conditions the plant which grow slow tend to produce no ear. If the hill method is to be followed, sufficient quantity of fertilizers must be applied.

Individual effect of nitrogen, phosphorus and potassium upon stem bearingness of corn were determined. Nitrogen significantly increased the average number of stalks bearing ears in most locations both years.

Table 6 shows the effect of the various amounts of nitrogen applied upon the average number of ears per stalk. The data indicate that corn bears as low as 0.69 ears per stalk without nitrogen fertilizer. When nitrogen fertilizer was applied, however, each corn plant will produce in some cases an average of 1.06 or 1.04 ears.

Phosphate application also significantly increased the average number of ears per stalk in one location in 1962 and two locations in 1963 experiments. The effect of potassium upon increasing stem bearingness of corn was not obtained from any location in 1962 and

therefore was not included in the studies of the 1963 experiments.

The effects of different levels of nitrogen and phosphorus on the average number of ear per stalk are illustrated in Figure 3.

IV. Effect of fertilizers upon the size of ear.

The size of ear was determined by means of the average weight of the ear which was obtained by dividing the total weight of grain at 15% moisture by the total number of ears in the harvested area.

The average weight of ear significanty increased due to ferttlizer treatments in all locations of the two year experiments. Analysis of variance indicated that the effects of fertilizers upon increasing size of ear are primarily due to the application of nitrogen. The effects of various quantities of nitrogen fertilizer applied upon the average weight of ear are shown in Table 7. In one location of the 1963 experiment, without nitrogen fertilizer the average weight of ear obtained was only 85.1 grams. When 32 kg. of N was applied the size of ear was increased to 132.2 grams.

It is interesting to note, also, that phosphate fertilizer increased the average weight of ear in many locations. The effect of various quantities of phosphate fertilizer applied upon the size of ear is shown in Table 8.

The effect of potash fertilizer upon the size of corn ear was not significant in all locations of the 1962 experiment.

It may be concluded from the data obtained that 8 to 16 kg. of nitrogen is required for the production of the largest ear size. Phosphorus gave the best ear when applied at the rate of 10 kg. P_2O_5/rai (Figure 4).

V. Effect of fertilizers upon the maturity of corn.

The influence of fertilization upon the maturity of corn was determined by the number of days required for tasseling and silking of the plant. The number of days from planting to the time of 80% tasseling and silking were recorded. The days of tasseling varied from 57 to 60 days whereas that of silking varied from 56 to 66 days. Analysis of variance showed that tasseling and silking of Guatemala corn of some locations were influenced by fertilizer treatments. It was evident that proper fertilizer treatments induced corn to tassel and silk sooner than those that received no fertilizer.

Silking, however, seemed to be more affected by fertilizer than tasseling. It was observed that nitrogen had a marked influence on the number of days required for silking (Figure 5) while phosphate fertilizer had a marked effect on the earlier tasseling for location low in available phosphorus in the soils (Figure 6).

SUMMARY

Fertilizer trials were established in 1962 and 1963 in order to determine the influence of nitrogen, phosphate and potash fertilizers upon the yield response

of Guatemala corn. Soils of different fertility levels were selected based on the soil test values. Results of the experiments can be concluded as the following:—

1. Effect of fertilizer on yield of grain.

Corn significantly responded to fertilization in all locations of the two years experiments. Increase in yield of grain is primarily due to the effect of nitrogen, followed closely by the effect of phosphate fertilizer.

Response of corn to potash fertilizer was not obtained in any location. Available potassium in soils is probably still sufficient for high yield of Guatemala corn.

Yield response of corn to fertilzation varied from 54 to 196 percent increase over that of the unfertilized plot in 1962 and varied from 30 to 139 percent increase over that of the check plot for the 1963 experiments.

The net return profit from fertilization was calculated. Data indicate that treatments that gave the highest economic yield return are not the same as those resulting in the maximum yield. The economical fertilizer treatments usually consisted of low to medium levels of N (8–16 kg. of N/rai), low phosphate level (8–10 kg. of P_2O_5/rai) whereas potash may not need to add at the present time or can be added at the rate not exceeding 8 kg. of K_2O/rai.

2. Effect of fertilizer on yield of corn stover.

In general the yield of stover increases with the application of fertilizers. Appropriate fertilizer treatments tend to increase grain more than stover.

As the amounts of nitrogen applied to the soil increase, the ratio of grain to stover becomes wider in all locations. The same is true for the effect of phosphate fertilizer but much less than that of nitrogen. Potash fertilizer, as indicated from the results of 1962, however, tend to increase stover more than grain in most locations.

3. Effect of fertilizer upon the number of ears per stalk.

Many locations indicate significant influence of fertilizer upon the number of ears per stalk. The influence of fertilizers upon the stem bearingness are largely due to the effect of nitrogen. Locations where available P in soils were low, phosphate fertilizer also significantly increased the number of ears per stalk.

4. Effect of fertilizer upon the size of ear.

Size of ear becomes larger due to the application of fertilizers. Both nitrogen and phosphorus are important for Guatemala corn to produce large ears.

5. Effect of fertilizer upon the maturity of corn.

As the levels of nitrogen and phosphate increase, corn tends to tassel and silk earlier, consequently the ear matures sooner.

สรุป

ผลจากการทดลองปุ๋ยข้าวโพดที่ปลูกในดินซึ่งมีระดับความอุดมสมบูรณ์ที่แตกต่างกัน ในปี 1962 และ 1963 เพื่อศึกษาอิทธิพลของไนโตรเจน ฟอสเฟทและปอแตช ที่มีต่อการเพิ่มผลผลิตของข้าวโพดนั้น พอสรุปโดยย่อได้ดังนี้.–

1. อิทธิพลของปุ๋ยที่มีต่อการเพิ่มผลผลิตของเมล็ด

เมื่อข้าวโพดกัวเตมาลาได้รับปุ๋ยผลผลิตของเมล็ดจะเพิ่มขึ้นอย่างเด่นชัด ในทุก ๆ แปลงที่ได้ทำการทดลอง ผลผลิตที่เพิ่มขึ้นส่วนใหญ่เนื่องจากอิทธิพลของไนโตรเจน และรองลงมาก็คือ ฟอสเฟท ส่วนผลตอบสนองเนื่องจากการใช้ปุ๋ยปอแตช ของทุก ๆ แปลงที่ทำการทดลองนั้นยังไม่ปรากฏเด่นชัด จึงใคร่สรุปในระยะนี้แต่เพียงว่า ระดับของปอแตสเซี่ยมในดิน ส่วนใหญ่ที่ใช้ในการปลูกข้าวโพดอย่างกว้างขวางนั้น ยังมีสูงพอเมื่อมีฟอสฟอรัสและไนโตรเจนเพียงพอที่จะส่งเสริมข้าวโพดกัวเตมาลา และมีผลผลิตสูงได้ โดยไม่ต้องใช้ปุ๋ยปอแตชเพิ่มเติม

ผลผลิตของเมล็ดข้าวโพดที่เพิ่มขึ้นเนื่องจากการใช้ปุ๋ยนั้นแตกต่างกันตั้งแต่ 54 ถึง 196 เปอร์เซ็นต์ ในปี 1962 และแตกต่างกันตั้งแต่ 30–139 เปอร์เซ็นต์ ในปี 1963 อัตราปุ๋ยที่สูงที่ใช้ในการทดลองครั้งนี้มักเป็นอัตราที่ให้ผลผลิตของเมล็ดสูงที่สุด

สำหรับกำไรจากการใช้ปุ๋ยนั้นปรากฏว่า อัตราปุ๋ยที่ให้ผลผลิตสูงสุดนั้นไม่จำเป็นต้องเป็นอัตราปุ๋ยที่ให้กำไรสูงสุด อัตราปุ๋ยที่มักจะให้กำไรสูงสุดต่อจำนวนเงินทุนที่ลงไปนั้น มักประกอบด้วยอัตราปุ๋ยซึ่งมีระดับไนโตรเจนต่ำถึงปานกลาง (8–16 กก. N/ไร่) และฟอสเฟทที่มีระดับต่ำ (8–10 กก. P_2O_5/ไร่) สำหรับปอแตชนั้นอาจไม่ต้องใช้ก็ได้ในระยะแรก ๆ แต่เพื่อจะรักษาความสมดุลย์กันในระดับธาตุอาหารทั้งสาม ก็ควรจะใช้ในอัตราไม่เกิน 8 กก. K_2O/ไร่

2. อิทธิพลของปุ๋ยที่มีต่อน้ำหนักของตอซัง

การใช้ปุ๋ยโดยทั่วไปก็จะเพิ่มน้ำหนักของตอซังข้าวโพดด้วยเช่นกัน แต่อัตราปุ๋ยที่เหมาะสม จะเพิ่มส่วนที่เป็นเมล็ดมากกว่าส่วนที่เป็นตอซัง

เมื่อระดับของไนโตรเจนสูงขึ้น อัตราส่วนระหว่างเมล็ดและตอซังจะกว้างขึ้นและเช่นเดียวกันเมื่อใช้ปุ๋ยฟอสเฟท แต่สัดส่วนที่เพิ่มขึ้นของเมล็ดเมื่อเปรียบเทียบกับตอซังนั้นจะน้อยกว่าไนโตรเจน ส่วนปอแตสเซี่ยมนั้นเมื่อใส่ลงไปในดินมากขึ้น จะมีแนวโน้มที่จะทำให้ข้าวโพดผลิตตอซังมากกว่าเมล็ด

3. อิทธิพลของปุ๋ยที่มีต่อการติดฝักของข้าวโพด

ผลของการทดลองหลายแห่งแสดงให้เห็นว่า การใช้ปุ๋ยมีส่วนช่วยในการติดฝักของข้าวโพดเป็นอย่างมาก โดยเฉพาะอย่างยิ่งไนโตรเจนสำหรับดินที่มีระดับฟอสฟอรัสที่ต่ำ การให้ปุ๋ยฟอสเฟทที่พอเพียงจะช่วยให้ข้าวโพดติดฝักดีขึ้น

4. อิทธิพลของปุ๋ยที่มีต่อขนาดของฝัก

ฝักข้าวโพดที่ได้รับปุ๋ยจะมีขนาดโตกว่าข้าวโพดที่ไม่ได้รับปุ๋ยเลย ทั้งไนโตรเจนและฟอสเฟทช่วยทำให้ขนาดของฝักข้าวโพดโตขึ้น

5. อิทธิพลของปุ๋ยที่มีต่ออายุที่แก่เก็บเกี่ยวได้ของข้าวโพด

เมื่อระดับของไนโตรเจนและฟอสเฟทสูงขึ้น ข้าวโพดที่ปลูกในดินโดยทั่วไปจะออกดอกตัวผู้และออกฝักเร็วขึ้น ดังนั้นจะมีผลทำให้ระยะเวลาระหว่างปลูกและเก็บเกี่ยวสั้นเข้า ทั้งนี้จะมีผลดีสำหรับการปลูกพืชรุ่นที่สอง ซึ่งจะมีระยะที่จะได้รับฝนนานขึ้น

Table 1 Yield of grain (at 15% moisture) as affected by various treatment combinations of N, P_2O_5, K_2O

Treatment No.	Adjusted yield Kg./rai			
	Tapra	Prabuddhabat	Pakchong	Muak Lek
0-0-0	249.04	236.16	436.27	481.95
8-0-0	324.38	453.66	478.26	577.66
16-0-0	406.70	370.13	555.34	488.46
24-0-0	487.94	462.32	423.70	
0-8-0	213.43	320.34	679.34	432.02
8-8-0	482.64	596.53	627.63	595.25
16-8-0	478.72	636.19	517.54	494.27
24-8-0	539.98	603.81	510.99	
0-16-0	221.31	254.10	573.07	258.58
8-16-0	480.22	535.42	563.63	488.18
16-16-0	450.05	598.03	524.99	746.05
24-16-0	579.84	586.10	533.26	
0-24-0	179.44	275.94	613.02	533.25
8-24-0	386.86	554.21	493.60	628.34
16-24-0	512.51	574.75	678.34	630.22
24-24-0	545.94	701.22	598.83	
0-0-8	316.26	309.44	545.94	526.85
8-0-8	379.50	453.34	561.30	418.78
16-0-8	497.79	408.27	528.72	711.82
24-0-8	367.67	447.25	508.94	
0-8-8	319.33	332.26	603.97	525.02
8-8-8	463.18	517.76	682.99	531.60
16-8-8	487.34	561.97	493.52	580.10
24-8-8	591.97	564.78	562.27	
0-16-8	292.66	397.30	576.08	365.12
8-16-8	502.50	505.04	536.27	445.70
16-16-8	542.91	549.18	615.12	718.75
24-16-8	518.61	626.75	542.34	
0-24-8	240.93	293.17	628.13	587.07
8-24-8	428.24	540.61	613.60	590.46
16-24-8	557.90	593.12	629.52	650.29
24-24-8	614.05	584.19	555.34	
0-0-16	149.26	432.99	432.53	423.33
8-0-16	417.20	406.00	545.09	540.67
16-0-16	371.18	515.60	638.54	616.03
24-0-16	304.10	430.80	666.40	
0-8-16	262.11	490.59	535.36	614.75
8-8-16	412.48	510.37	547.95	546.21
16-8-16	541.44	538.94	559.20	611.81
24-8-16	596.24	578.03	635.73	
0-16-16	220.78	414.62	533.76	382.75
8-16-16	432.06	552.61	550.19	533.94
16-16-16	521.79	560.72	504.22	619.18
24-16-16	632.66	516.85	591.12	
0-24-16	174.58	419.92	550.59	387.66
8-24-16	405.23	476.10	524.78	564.58
16-24-16	585.62	541.02	619.18	575.30
24-24-16	657.42	565.84	660.21	
% Max. yield increase	164.0%	196.0%	56.0%	54.0%
C.V.	10.81	11.55	6.64	22.80
L.S.D. .05	124.64	119.74	140.26	229.18
L.S.D. .01	165.76	159.26	186.54	304.82

Table 2. Yield of grain (at 15% moisture) as affected by various treatment combinations of N and P_2O_5 when K_2O was maintained at 8 kg./rai.

Rank	Location I Nai Chunt's		Location II Nai Muan's		Location III Nai Tium's		Location IV Nai Prome's		Location V Prabuddhabat Agr. Exp. Sta.		Location VI Pakchong Agron. Farm	
	treatment	Kg/rai	treatment	Kg./rai	treatment	Kg./rai	treatment	Kg./rai	treatmant	Kg./rai	treatment	Kg./rai
1	24-20-8	1028	32-10-8	1024	24-10-8	994	32-30-8	896	24-10-8	1117	32-30-8	618
2	32-20-8	1027	32-30-8	910	16-0-8	952	16-20-8	844	16-10-8	1081	24-20-8	616
3	24-30-8	984	16-30-8	875	24-0-8	952	16-20-8	809	24-20-8	1072	8-10-8	604
4	32-10-8	966	24-30-8	875	32-10-8	943	16-20-8	807	16-20-8	1027	8-20-8	601
5	16-30-8	964	32-0-8	874	16-10-8	933	32-20-8	787	32-20-8	1024	32-10-8	583
6	16-10-8	948	16-10-8	857	8-20-8	932	24-10-8	773	16-0-8	972	32-0-8	579
7	16-20-8	935	24-0-8	839	32-10-8	921	24-20-8	758	32-30-8	967	24-10-8	578
8	24-10-8	935	24-0-8	839	32-10-8	920	24-30-8	744	16-30-8	963	8-30-8	574
9	32-30-8	922	16-20-8	812	8-10-8	914	8-20-8	738	8-10-8	957	0-10-8	574
10	8-20-8	852	8-10-8	788	16-30-8	907	16-10-8	725	24-0-8	925	32-30-8	571
11	8-30-8	849	24-20-8	785	32-0-8	907	8-30-8	706	24-30-8	894	0-30-8	565
12	8-10-8	827	8-30-8	784	8-30-8	891	8-10-8	704	0-10-8	853	8-0-8	556
13	0-30-8	655	16-0-8	778	32-30-8	878	32-0-8	674	32-10-8	852	16-10-8	555
14	24-0-8	625	32-10-8	763	24-20-8	850	8-0-8	616	8-20-8	831	0-20-8	551
15	8-0-8	619	8-20-8	734	16-20-8	847	16-0-8	612	0-20-8	823	16-0-8	538
16	0-10-8	601	0-30-8	622	8-0-8	794	24-0-8	603	0-30-8	819	16-30-8	536
17	32-0-8	594	0-0-8	592	0-0-8	673	0-10-8	526	8-0-8	802	24-30-8	527
18	0-20-8	567	8-0-8	590	0-10-8	647	8-20-8	452	8-30-8	785	16-20-8	521
19	16-0-8	485	0-10-8	584	0-30-8	643	0-0-8	375	32-0-8	751	24-0-8	511
20	0-0-8	454	0-20-8	558	0-20-8	602	0-30-8	364	0-0-8	669	0-0-8	476
	C.V.= 15.42% % Max.yield increase = 126.4		C.V.= 18.61% % Max.yield increase = 73.0		C.V.= 16.5% % Max.yield increase = 47.9		C.V.= 16.21% % Max.yield increase = 138.9		C.V.=16.7% % Max.yield increase = 66.7		C.V.= 13.0% % Max.yield increase = 29.8	

Table 3. Net return profits from the application of fertilizers* (1962)

Treatment No	Cost of fert. baht/rai	Net return profit, baht/rai			
		Tapra Agri. Exp Sta	Prabuddhabat Agri Exp. Sta.	Agron. Farm Pakchong	Veteran Farm Muak Lek
0-0-0	0	0	0	0	0
8-0-0	38.28	18.68	124.85		33.51
16-0-0	76.56	41.68	23.92	12.75	
24-0-0	114.84	64.33	54.78		
0-8-0	36.00		27.13	146.30	
8-8-0	74.28	100.92	196.00	69.24	10.70
16-8-0	112.56	59.70	187.46		
24-8-0	150.84	67.36	124.90		
0-16-0	72.00				
8-16-0	110.28	63.10	114.15	30.60	
16-16-0	148.56	3.20	122.84		49.52
24-16-0	186.84	61.23	75.61		
0-24-0	108.00			24.57	
8-24-0	146.28		92.26		
16-24-0	184.56	13.04	69.38		
24-24-0	222.84		125.95		
0-0-8	19.95	30.46	35.01	62.31	13.73
8-0-8	58.23	39.61	104.65	35.55	
16-0-8	96.51	90.05	32.57		75.90
24-0-8	134.79		23.53		
0-8-8	55.95		16.12	69.83	
8-8-8	94.23	66.37	116.97	90.81	
16-8-8	132.51	46.21	111.85		
24-8-8	170.79	86.41	75.68		
0-16-8	91.95		28.90		
8-16-8	130.23	59.86	71.43		
16-16-8	168.51	51.89	66.26		9.09
24-16-8	206.79		86.15		
0-24-8	127.95			15.95	
8-24-8	166.23		62.11		
16-24-8	204.51	27.13	63.21		
24-24-8	242.79	30.49	18.23		
0-0-16	39.90		107.72		
8-0-16	78.18	47.94	49.20	3.44	
16-0-16	116.46		93.12	35.25	
24-0-16	154.74			17.86	
0-8-16	75.90		115.02		23.70
8-8-16	114.18	8.40	91.48		
16-8-16	152.46	66.84	74.62		
24-8-16	190.74	69.66	65.66		
0-16-16	111.90		21.94		
8-16-16	150.18		87.16		
16-16-16	188.46	16.10	54.96		
24-16-16	226.74	60.97			
0-24-16	147.90				
8-24-16	186.18				
16-24-16	224.46	27.97	4.18		
24-24-16	262.74	43.54			

* The net return profits = total value of grain obtained - (value of grain in 0-0-0 + cost of fertilizer used in the corresponding treatment)

When the grain was sold at ฿ 0.75 per kilogram

Urea cost ฿ 2.20 per kilo.

Double superphosphate cost ฿ 1.80 per kilo

Muriate of potash cost ฿ 1.55 per kilo

Table 4. Net return profits from the application of fertilizers* (1963)

Rank	Treatment	Cost of Fert.	Net return profits, baht/rai					
			Location I Nai Chunt's	Location II Nai Nuan's	Location III Nai Tium's	Location IV Nai Promo's	Location V Prabuddhabat Agr. Exp. Sta.	Location VI Pakchong Agronomy Farm
1	0-0-8	20.70	0	0	0	0	0	0
2	8-0-8	59.00	64.75	-	31.75	121.75	40.75	21.70
3	16-0-8	97.30	-	42.20	111.95	80.45	129.95	-
4	24-0-8	135.20	-	50.05	74.05	35.80	56.80	-
5	32-0-8	173.50	-	38.00	1.25	50.75	-	-
6	0-10-8	65.70	44.55	-	-	47.55	72.30	28.50
7	8-10-8	104.00	175.75	43.90	76.75	142.75	112.00	12.70
8	16-10-8	142.30	228.20	56.45	52.70	120.20	166.70	-
9	24-10-8	180.60	178.65	-	60.15	117.90	155.40	-
10	32-10-8	218.90	165.10	-	-	105.10	-	-
11	0-20-8	110.70	-	-	-	-	4.80	-
12	8-20-8	149.00	149.50	-	45.25	23.25	-	-
13	16-20-8	187.30	173.45	-	-	126.20	81.20	-
14	24-20-8	225.60	204.90	-	-	61.65	76.65	-
15	32-20-8	263.90	165.85	60.10	-	45.10	2.45	-
16	0-30-8	155.70	-	-	-	-	-	-
17	8-30-8	194.00	102.25	-	-	54.25	-	-
18	16-30-8	232.30	150.20	-	-	119.45	-	-
19	24-30-8	270.60	126.90	-	-	6.15	-	-
20	32-30-8	308.90	42.10	-	-	81.85	-	-

* The net return profits =total value of grain obtained - (value of grain in 0-0-8 + cost of fertilize used in the corresponding treatment)
When the grain was sold at B 0.75 per kilogram
Urea cost B 2.20 per kilo.
Double superphosphate cost B 1.80 per kilo.
Muriate of potash cost B 1.55 per kilo.

Table 5. Effects of nitrogen, phosphate and potash fertilizers upon grain to stover ratio at various locations. (1962 results)

Amounts' of N, P_2O_5 & K_2O applied Kg./rai	Effect of N			Effect of P_2O_5			Effect of K_2O		
	Ratio of grain : Stover			Ratio of grain : Stover			Ratio of grain : Stover		
	Prabuddhabat Exp. Sta.	Agron. Farm Pakchong	Tapra Exp. Sta.	Prabuddhabat Exp. Sta.	Agron. Farm Pakchong	Tapra Exp. Sta.	Prabuddhabat Exp. Sta.	Agron. Farm Pakchong	Tapra Exp. Sta.
0	0.55	0.64	0.81	0.64	0.64	1.04	0.73	0.67	1.08
8	0.74	0.68	1.11	0.71	0.65	1.03	0.69	0.65	1.00
16	0.78	0.65	1.06	0.71	0.67	0.99	0.67	0.66	0.92
24	0.71	0.66	0.97	0.71	0.67	0.97	-	-	-

(1963 results)

Amount of nitrogen applied per rai	Effect of N				Amount of P_2O_5 applied per rai	Effect of P_2O_5			
	Ratio of grain : Stover					Ratio of grain : Stover			
	Prabuddhabat Exp. Sta.	Nai Chunt's Farm	Nai Tium's Farm	Nai Prome's Farm		Prabuddhabat Exp. Sta.	Nai Chunt's Farm	Nai Tium's Farm	Nai Prome's Farm
0	0.89	1.06	0.92	0.81	0	1.01	1.09	1.13	1.10
8	0.97	1.15	1.13	1.18	10	1.04	1.29	1.13	1.14
16	1.11	1.31	1.16	1.28	20	1.01	1.27	1.06	1.17
24	1.05	1.32	1.17	1.16	30	0.96	1.20	1.04	1.24
32	1.07	1.22	1.05	1.34					

Table 6. Effect of nitrogen upon the average number of ear per stalk during 1962 and 1963.

Amount of nitrogen appl. Kg./rai	1962 Average Number of ear per stalk		1963 Average number of ear per stalk			
	Prabuddhabat Agr. Exp. Sta.	Tapra Agr. Exp. Sta.	Loc. II Nai Juan's	Loc. III Nai Tium's	Loc. IV Nai. Prome's	Loc. V Prabuddhabat Agr. Exp. Sta.
0	0.79	0.69	1.01	0.98	0.93	0.87
8	0.93	0.87	1.05	1.02	1.02	0.93
16	0.91	0.88	1.06	1.03	1.01	0.97
24	0.90	0.87	1.06	1.03	1.02	0.86
32	–	–	1.06	1.00	1.04	0 84

Table 7. The effect of nitrogen upon the average weight of ear during 1962 and 1963.

1962

Amount of fertilizer appl. Kg. of N/rai	Average weight of corn ear. gm.			
	Prabuddhabat Agr. Exp. Sta. Loc.	Agron. Farm Pakchong Loc.	Tapra Agr. Exp. Sta. Loc.	Muak Lek Veteran Farm, Loc.
0	60.2	79.7	51.6	63.0
8	76.1	81.0	74.0	72.1
16	83.1	82.0	83.3	83 5
24	86.3	81.3	93.5	–

1963

Amount of fertilizer appl. Kg. of N/rai	Average weight corn ear, gm.					
	Loc. I Nai Chunt's Farm	Loc. II Nai Nuan's Farm	Loc. III Nai Prome's Farm	Loc. IV Nai Tium's Farm	Loc. V Prabuddhabat Agr. Exp. Sta.	Loc. VI Agron. Farm Pakchong
0	85.1	97.5	99.0	79.0	109.0	94.0
8	114.7	120.9	123.0	113.0	119.0	100.0
16	120.7	135.4	123.0	122.0	138.0	92.0
24	131.5	139.1	134.0	120.0	137.0	97.0
32	132 2	133.3	135.0	122.0	135.0	98.0

Table 8. The effect of phosphorus upon the average weight of ear during 1962 and 1963 experiments

1962

Amount of fertilizer appl. Kg. of P_2O_5 / rai	Average weight of ear, gm.			
	Prabuddhabat Agr. Exp. Sta. Loc.	Agron. Farm Pakchong Loc.	Tapra Agr. Exp. Sta. Loc.	Muak Lek Veteran Farm Loc.
0	67.6	74.3	68.7	71.3
8	79.2	83.0	75.9	74.4
16	78.7	80.3	79.3	68.7
24	80.1	86.0	78.5	73.3

1963

Amount of fertilizer appl. Kg. of P_2O_5 / rai	Average weight of ear, gm.					
	Loc. I Nai Chunt's Farm	Loc. II Nai Nuan's Farm	Loc. III Nai Tium's Farm	Loc. IV Nai Prome's Farm	Loc. V P.B.Ag Exp. Sta.	Loc. VI Agron. Farm Pakchong
0	89.3	120.9	–	98.0	119.0	92.0
10	121.8	129.9	–	116.0	130.0	97.0
20	126.9	124.3	–	115.0	132.0	97.0
30	129.2	125.9	–	116.0	129.0	98.0

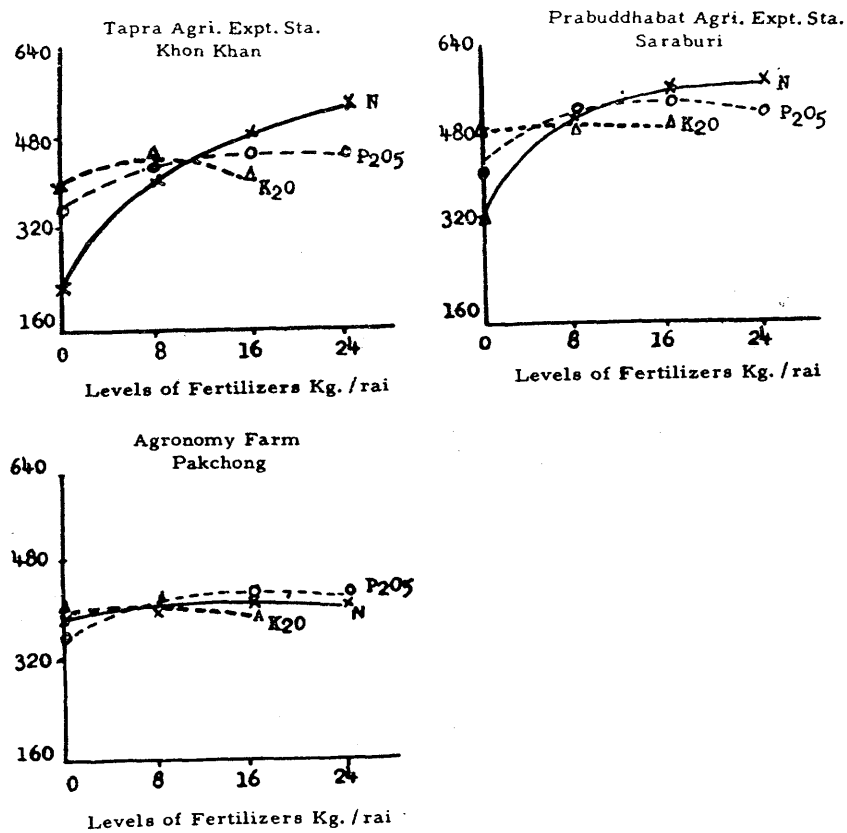

Fig. 1. Individual yield response curve to N, P_2O_5 and K_2O.

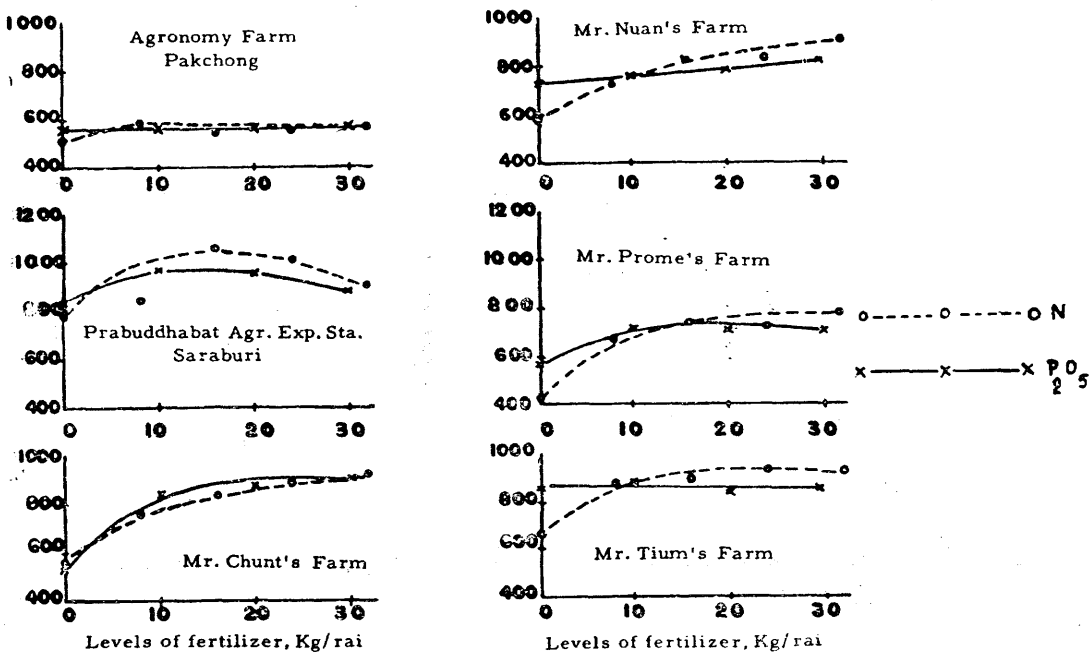

Fig. 2. Individual responses of grain (15% moisture) to different levels of N and P_2O_5 applied at various locations.

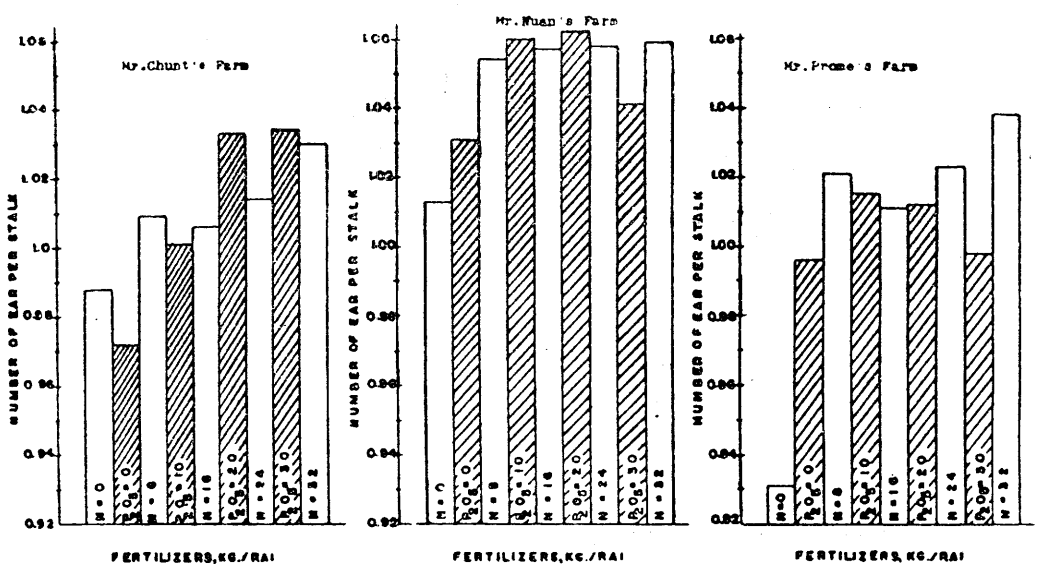

Fig. 3. Effects of different levels of N and P_2O_5 on the average number of ear per stalk.

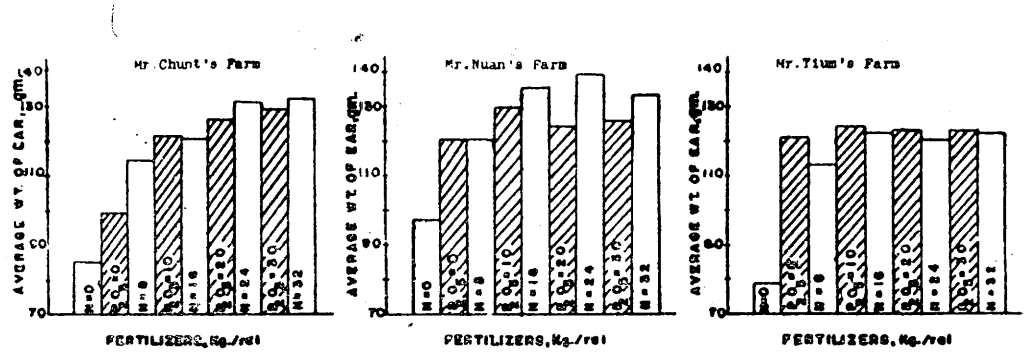

Fig. 4. Effects of different levels of N and P_2O_5 on the average weight of ear.

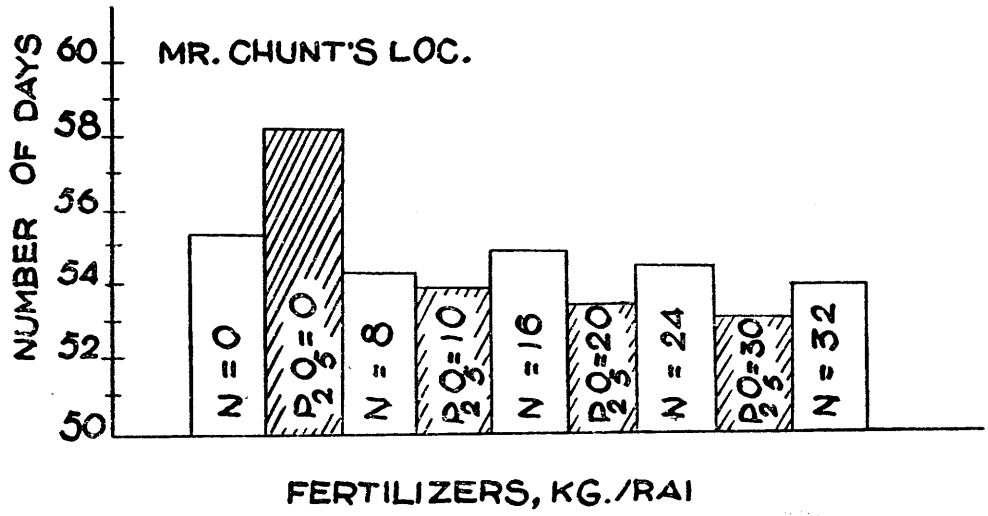

Fig. 5. Effects of nitrogen and phosphorus on the number of days required for tasseling of Guatemala Corn.

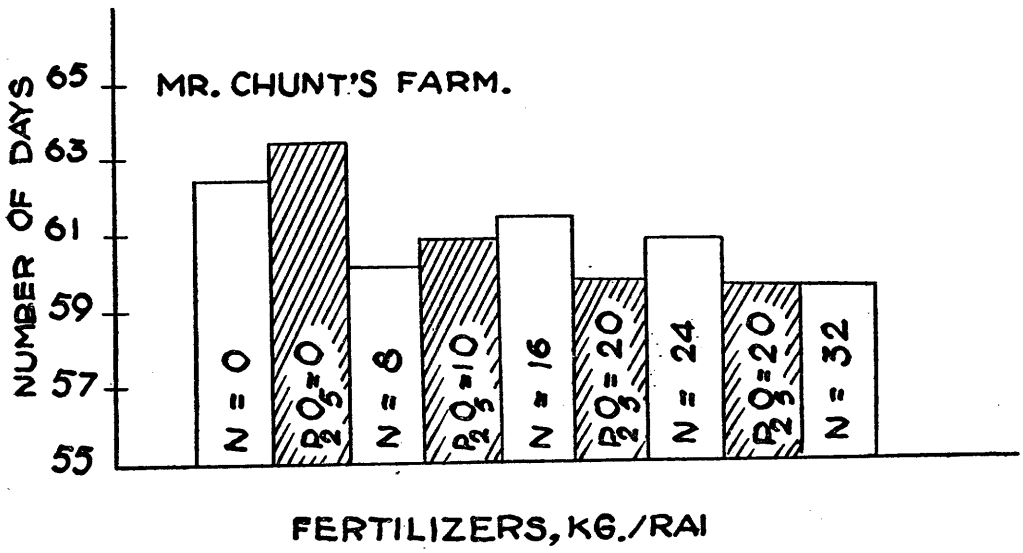

Fig. 6. Effects of nitrogen and phosphorus on the number of days required for silking of Guatemala Corn.