

Response of rice to potassium fertilizer in the Matara district

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(Received May, 1972)

SUMMARY

THE low status of available potassium in most rice soils of the wet zone probably limits productivity. Yield responses to higher levels of potassium over that currently recommended for the area confirm this view.

A yield increase of approximately 10 bushels paddy per acre was obtained by increasing the basal application of muriate of potash from 56 to 84 lbs. per acre at 40 lbs. nitrogen per acre. An additional 42 lbs. muriate of potash applied two weeks before heading resulted in a further yield increase of approximately 7.0 bushels paddy per acre. A basal application of 126 lbs. per acre of muriate of potash together with 60 lb. nitrogen per acre yielded approximately 10 bushels paddy per acre over the lower levels of nitrogen and potassium.

The yield increase from the use of the granular-compound-fertilizer 15-15-15 : N-P₂O₅-K₂O over that of 15-15-6-4 : N-P₂O₅-K₂O₂-MgO adds confirmation to the above results.

These results demonstrate the importance of applying a high amount of potassium as a basal dressing and the benefit of applying some potassium as a top dressing two weeks before heading time.

INTRODUCTION

Potassium is an element essential for the growth of all plants. Among the basic metallic elements, potassium is absorbed in the largest quantities by plants although its functions are still not fully known.

Yield increases in rice due to potassium are generally less than those due to nitrogen and phosphorus. While the importance of nitrogen and phosphorus in the nutrition of rice is well recognised that of potassium is still controversial. According to Grist (7), potassium applications may have negative effects on yield under certain conditions unless the soils is deficient in this element. On the other hand, remarkable responses to potassium have been reported from several countries (3, 4, 8, 10, 13, 15). The need for high rates of potassium fertilization may not be so obvious under low levels of management as under high levels when high grain yields are expected with improved varieties of rice.

Potassium has been shown (i) to play an important role in carbohydrate metabolism, (ii) to increase the resistance of rice plants to disease and (iii) to help plants in adapting themselves to adverse climatic conditions. The poor status of available potassium in most rice soils of the low country wet-zone of Sri Lanka is probably a factor which limits productivity.

Potassium fertilization is always recommended at planting for rice in Sri Lanka (5). In the wet zone top dressings are invariably recommended in addition to the basal dressing because this element is easily lost from the soil due to leaching in this region of relatively high rainfall. The intensity of leaching of potassium from soils depends on the composition of the soil. It is held very weakly on organic colloids as compared to adsorption on two or three layered clay minerals (9,14,19,20). This relatively larger amount of potassium is lost from soils in which organic matter contributes largely to the exchange properties of soils, as for example the high humic and sandy rice soils of low clay content. Fertilizer potassium added to such soils will remain largely in the soil solution and run the risk of being easily lost from the soil due to leaching or surface run-off.

This paper presents results of fertilizer experiments conducted in the Matara district, a preliminary report of which was presented earlier (21).

MATERIALS AND METHODS

The administrative district of Matara is situated in the Southern Province of Sri Lanka. The greater part of the district is within the wet zone. This district receives an annual rainfall between 50 to 125 inches. An appreciable part of this rainfall is confined to the period of the South-West Monsoon in the area of the district which comes within the wet-zone. The mean annual temperature of the area is 80°F., the mean annual minimum and maximum temperatures being 75°F and 82°F respectively.

The characteristics of the soils at the locations of the experiments are shown in Table 1.

A. A field experiment was conducted at the Department of Agriculture farm, Mapalana in the Matara district during Maha season 1966/67 to study the effect of potassium fertilization on rice.

The treatments were as follows :—

- (1) No potassium fertilizers.
- (2) Potassium at the rate of 28 lbs. of K_2O per acre applied as a preplant dressing.
- (3) Potassium at the rate of 42 lbs. of K_2O per acre applied as a preplant dressing.
- (4) Potassium at the rate of 63 lbs. of K_2O per acre applied as a preplant dressing.

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- (5) Potassium at the rate of 28 lbs. of K_2O per acre applied as a preplant dressing, and 14 lbs. K_2O per acre applied as a top dressing 2 weeks before heading.
- (6) Potassium at the rate of 28 lbs. of K_2O per acre applied as a preplant dressing and 28 lbs. of K_2O per acre applied as a top dressing 2 weeks before heading.

Treatment 5 corresponds to the fertilizer recommendation of the Department of Agriculture for the area (5).

All treatments received nitrogen and phosphorus at rates and times recommended by the Department of Agriculture for the area. They were 39 lbs. N and 47 lbs. P_2O_5 per acre in the form of urea and rock phosphate (saphos phosphate) respectively. The entire quantity of phosphorus was applied as a preplant (basal) dressing and nitrogen was applied in three split doses ; 1 week after planting, 2 weeks before heading and at heading. Potassium was applied in the form of muriate of potash, 50% grade.

The experiment was laid down as a randomized complete block design with 4 replicates. The variety of rice used was H-8.

B. During Yala 1967 a series of trials were conducted in cultivators' fields in the Matara district to study the response of rice to increased applications of both potassium and nitrogen. They were conducted in seven locations viz. Talalla, Dampella, Lalpe, Hathamune, Mapalana, Karagoda-Uyangoda and Pallegama.

Seven fertilizer treatments were tested out at each location where treatments were randomized and each location was treated as a replicate of the main experiment, which was considered a randomized complete block design.

The treatments were as follows :—

- (1) Nitrogen, phosphorus and potassium applied at rates and times specified in the recommendations of the Department of Agriculture.
- (2) Potassium at the rate of 42 lbs. of K_2O per acre applied as a preplant dressing and nitrogen at the rate of 40 lbs. per acre applied as top dressings.
- (3) Potassium at the rate of 63 lbs. of K_2O per acre applied as a preplant dressing and nitrogen at the rate of 40 lbs. per acre applied as top dressings.
- (4) Potassium at the rate of 42 lbs. of K_2O per acre applied as a preplant dressing and nitrogen at the rate of 40 lbs. per acre with potassium at the rate of 21 lb. K_2O per acre applied as top dressings.
- (5) Potassium at the rate of 42 lbs. of K_2O per acre applied as a preplant dressing and nitrogen at the rate of 60 lbs. per acre applied as top dressings.
- (6) Potassium at the rate of 63 lbs. K_2O per acre applied as a preplant dressing and nitrogen at the rate of 60 lbs. per acre applied as top dressings.

- (7) Potassium at the rate of 42 lbs. of K_2O per acre applied as a preplant dressing and nitrogen at the rate of 60 lbs. per acre with potassium at the rate of 21 lbs. K_2O applied as top dressings.

Phosphorus at the rate of 48 lbs. P_2O_5 per acre was applied as a preplant dressing of rock phosphate (saphos phosphate) to all treatments, as recommended by the Department of Agriculture (5). Nitrogen was applied in the form of urea and was applied in split doses at times recommended by the department i.e. at 2, 10 and 12 weeks after planting. Potassium was applied as muriate of potash 50 percent grade. The variety H4 was used at all locations, and was row sown at 6 locations and row planted at 1 location with equal number of rows in each plot.

C. Results of an investigation with granular-compound-fertilizers conducted in cultivators' fields of the Matara district during the Yala season of 1967, and which have been reported elsewhere (22), are also briefly included in this report for it affords further evidence that increased yields of rice could be obtained by increased use of potassium on these rice soils. This investigation was also conducted at the same locations as the straight fertilizer experiment described above. The treatments were as follows :—

- (1) No fertilizers.
- (2) Straight fertilizers applied according to recommendations of the Department of Agriculture.
- (3) 300 lbs. per acre of granular-compound-fertilizer 15-15-15 : N- P_2O_5 - K_2O applied at sowing or planting to supply 45 lbs. each of N, P_2O_5 and K_2O .
- (4) 300 lbs. per acre of granular-compound-fertilizer 15-15-15 : N- P_2O_5 - K_2O applied four weeks after sowing or one week after planting to supply 45 lbs. each of N, P_2O_5 and K_2O .
- (5) 300 lbs. per acre of granular-compound-fertilizer 15-15-6-4 : N- P_2O_5 - K_2O -MgO applied at sowing or planting to supply 45 lbs. each of N and P_2O_5 , 18 lbs. K_2O and 12 lbs. MgO.
- (6) 300 lbs. per acre of granular-compound-fertilizer 15-15-6-4 : N- P_2O_5 - K_2O -MgO applied four weeks after sowing or one week after planting to supply 45 lbs. each of N and P_2O_5 , 18 lbs. K_2O and 12 lbs. MgO.

In the three experiments A, B and C, the size of plots was 30 ft. by 14½ ft. Bunds 1 foot broad and 9 inches high separated adjacent plots.

During the Yala season the optimum amount of water was maintained throughout the growing period upto two weeks before harvesting. Pests and diseases were controlled whenever they appeared. A one foot border row was removed from each of the treatments. The balance area was harvested and paddy dried, threshed, winnowed and grain yields recorded. Corrections for moisture content were made before calculating plot yields.

RESULTS AND DISCUSSION

A. Response to potassium fertilizer at Department of Agriculture Farm, Mapalana.

The effect of potassium fertilization on the yield of grain at the Department of Agriculture Farm, Mapalana, is shown in Table 2. It will be noted that grain yields were significantly reduced when no potassium was applied to the soil and that 28 lbs. K_2O per acre was sufficient to increase grain yield from 36.6 bushels per acre to 44.7 bushels per acre. This yield increase was statistically significant. Levels of potassium above 28 lbs. K_2O (i.e. 56 lbs. muriate of potash) per acre applied either totally as a preplant basal application or in split applications did not significantly increase yields of grain at this location under the conditions of this experiment. This is most probably because the soil at the farm had sufficient exchangeable potassium (0.22 to 0.26 m.e.k+ per 100 gm soil) which together with the supplemental preplant basal dressing of 28 lbs. K_2O per acre could meet the demands of the rice crop.

B. Response of potassium and nitrogen fertilizers in cultivators' fields

The yield data of the experiments in cultivators' fields at seven locations of the district are presented in Table 3. The table includes yields per treatment at each location and the corresponding average yields of the seven locations. The results were significant at the 0.1 percent level of probability.

Treatment 1 which received nitrogen, phosphorus and potassium according to recommendations of the Department of Agriculture yielded less than all other treatments. This treatment received a preplant application of only 28 lbs. of K_2O per acre plus a top dressing of 14 lbs. K_2O per acre two weeks before heading together with a total quantity of approximately 39 lbs. N per acre at five locations. These are the departmental recommendations for the Morawak Korale, the Kandabada Pattuwa and the Gangabada Pattuwa of the district. Yield due to fertilizers applied according to the rates and times recommended by the Department of Agriculture, that is treatment 1, was inferior to treatment 2 and all other treatments at the 0.1 percent level of probability.

The main difference between treatments 1 and 2 was that 42 lbs. K_2O per acre were all applied at or before planting in the latter treatment while only 28 lb. of K_2O per acre were applied at or before planting in the former. These results indicate that it is more beneficial when 42 lbs. K_2O per acre were all applied as a basal dressing than when only 28 lbs. were applied as a basal dressing and the balance 14 lbs. were top dressed two weeks before heading.

It will also be noted that a preplant application of 63 lbs. K_2O per acre with 40 lbs. N per acre, as in treatment 3, contributed to a yield increase of only approximately 4 bushels per acre, and this difference was not significant. On the other hand two split applications of the total 63 lbs. K_2O per acre at the same level of nitrogen in treatment 4 resulted in a significant yield increase

of 7.3 bushels per acre over treatment 2 which received only 42 lbs. K_2O per acre. Apparently the soil is incapable of retaining the relatively high concentration of cations from 126 lbs. of muriate of potash, 63 lbs. K_2O per acre, when all are applied at once to enable plants to utilize this nutrient during the course of their growth. Hence, the superiority of split applications, where 42 lbs. K_2O are supplied at or before planting and the balance is supplied two weeks before heading, as in treatment 4. The superiority of split applications involving top dressings of potassium for rice on the humic rice soils of Bombuwela have been reported by Fernando (6), and split applications of this element are recommended for rice in most parts of the wet zone (5).

Comparison of yields in treatments 5 and 2 shows a highly significant yield increase of 8.3 bushels per acre due to an additional 20 lbs. nitrogen per acre in the former treatment. The level of potassium in both treatments was 42 lbs. K_2O per acre, applied at or before planting. Application of 63 lbs. K_2O per acre together with 60 lbs. N per acre as in treatment 6 gave a yield increase of 10.4 bushels per acre over treatment 2 which received only 42 lbs. K_2O and 40 lbs. N per acre. This yield difference was significant at the 0.1 per cent level of probability. The yield difference between treatments 7 and 2 was not as wide as between treatments 6 and 2, and this difference was significant only at the 5 percent level of probability. This may probably mean that at higher levels of nitrogen more potassium is required initially to obtain maximum yields. It should be noted that treatment 7 received only 42 lbs. K_2O as a basal application in contrast to treatment 6 which received 63 lbs. K_2O per acre as a basal application. There were, however, no significant differences between treatments that received 60 lbs. N per acre together with 42 or 63 lbs. K_2O per acre. The response to an additional 20 lbs. N per acre when 63 lbs. K_2O were applied as a preplant dressing was a significant 6.2 bushels per acre (comparison of treatments 6 and 3).

C. *Response to granular-compound-fertilizers of different potassium contents*

The results of fertilizer trials using the two granular-compound-fertilizers, 15-15-15 : $N-P_2O_5-K_2O$ and 15-15-6-4 : $N-P_2O_5-K_2O-MgO$, Sunfoska grades A and B respectively, conducted in cultivators' fields of the district are presented in Table 4 and have been reported elsewhere (22).

The use of the fertilizer 15-15-6-4 : $N-P_2O_5-K_2O-MgO$ resulted in a relatively lower yield in comparison to the fertilizer 15-15-15 : $N-P_2O_5-K_2O$. This average yield reduction of approximately 10 bushels grain per acre may be attributed to the lower content of K_2O (27 lbs. less) supplied by the former in comparison to the latter. While 300 lbs. of the former supplies 45 lbs. each of N, P_2O_5 and K_2O the same quantity of the latter supplies 45 lbs. each of N and P_2O_5 but only 18 lbs. K_2O per acre (and 12 lbs. MgO).

The yields of both treatments which received the fertilizer 15-15-6-4- N-P₂O₅-K₂O-MgO were not significantly different from that of the straight fertilizer treatment (Treatment 2). The straight fertilizer treatment received 28 lbs. K₂O per acre at planting at all locations and an additional top dressing of 14 lbs. K₂O per acre at five locations.

The source of potassium in the two granular-compound-fertilizers was the same as that in the straight fertilizer treatment, i.e., muriate of potash. The relatively low yield due to this, that is, 15-15-6-4, N-P₂O₅-K₂O-MgO, granular-compound-fertilizer treatment, could reasonably be attributed to the low K₂O content supplied to the plants.

According to results of Noguchi, and Sugawara (16) rice needs potassium for its entire growth period, and according to Kiuchi(II) potassium absorbed during 35-45 days before heading was most effective in increasing grain yields. Potassium has been reported to exert a favourable influence on tillering, grain size and the weight per 1,000 grains (8, 16). This element together with phosphorus increases the resistance of the plants to lodging and to both fungal and bacterial diseases even under adverse climatic conditions. (1, 2, 8, 10, 12, 17, 23). The susceptibility to disease due to inadequacy of potassium is more when plants are fertilized with only nitrogen. Since this element has been shown to be effective in promoting healthy plant growth, the use of potassium fertilizers would be most important when varieties capable of responding to higher levels of fertilizers are used in the future. With these varieties it would be very essential to supply balanced amounts of both potassium and phosphorus together with heavy applications of nitrogen.

D. *Potassium availability in rice soils of the district.*

The levels of exchangeable potassium in soils at experimental locations were presented in Table 1. An idea of exchangeable potassium in the district is given below.

The poor status of available potassium in rice soils of the district is seen from data in Table 5 which presents the frequency distribution of exchangeable potassium in 134 samples of top soils collected at random from rice fields.

It will be noted that as much as 70 per cent. of the samples had values of less than 0.20 m.e. K⁺ per 100 gm. soil in the exchangeable-plus-soluble fraction of soil potassium. These results are in agreement with the findings of Panabokke and Nagarajah (18). A value of less than 0.20 m.e. exchangeable-plus-soluble potassium per 100 gm. soil is considered to be low, and this emphasises the need for adequate potassium fertilization for rice in this district.

Economics of fertilizer use in cultivators' fields.

The economics of the use of potassium and nitrogen straight fertilizers according to data is shown in Table 6.

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The cost of the fertilizers was calculated from c.i.f. values furnished by the Sri Lanka Fertilizer Corporation and the price of paddy was taken at Rs. 14/-per bushel. Yield increases and net returns have been calculated relative to treatment 1, which is the fertilizer recommendation of the Department of Agriculture. Total net income is the value of yield at the above price of paddy minus the cost of fertilizers. Net return is taken as the value of yield increase (relative to treatment 1) due to fertilizer application minus the cost of fertilizer. It will be noted that the highest net income and net return were from treatment 6 the yield of which was significantly different only from treatments 1, 2 and 3. Further, among treatments 4, 5 and 6 which were not significantly different from each other, treatment 4 cost the least. From these figures it appears that it is economical to apply 63 lbs. K_2O and 40 lbs. N, per acre. than to apply 42 lbs. K_2O and 60 lbs. N per acre as in treatment 5.

Between treatments 3 and 4, fertilizers for which cost the same, the latter treatment appears to be superior to the former. This is probably because 63 lbs. K_2O were given in two split applications rather than in a single dose at or before planting.

The economics of the use of the two granular compound fertilizers in the district are presented in Table 7. The use of 15-15-6-4 : N- P_2O_5 - K_2O -MgO has been shown to give a lower return than 15-15-15 : N- P_2O_5 - K_2O , and this could be attributed to the lower content of potassium in the former fertilizer.

CONCLUSIONS

The results of these experiments indicate that a yield increase of approximately 10 bushels paddy per acre could be obtained by increasing the basal or preplant application of muriate of potash from 56 to 84 lbs. per acre (to supply 42 lbs. K_2O per acre) with 40 lbs. nitrogen per acre. A top dressing of 42 lbs. muriate of potash (21 lbs. K_2O) per acre two weeks before heading could give an additional yield of approximately 7.0 bushels per acre. At the higher level of nitrogen fertilization (i.e., 60 lbs. per acre) the indications are that the higher rate of 126 lbs. per acre of muriate of potash (to supply 63 lbs. K_2O per acre) yields approximately 10 bushels grain over the lower levels of nitrogen and potassium (40 lbs. N and 42 lbs. K_2O per acre). Data from experiments using granular-compound-fertilizers confirm the need for the higher basal dressing of muriate of potash at the present level of nitrogen fertilization—i.e., 40—45 lbs. N per acre.

ACKNOWLEDGEMENTS

Sincere appreciation is expressed to Mr. E. C. Weerasinghe, former D.A.E.O., Matara and his field staff for assistance in conducting the experiments in cultivators' fields.

Thanks are also due to Mr. Michael Silva, former Farm Manager, Government Farm, Mapalana for all assistance in conducting the experiment at the farm.

Acknowledgement is also due to Mr. T. B. Perera of the Division of Chemistry, C.A.R.I., for valuable help extended during the harvesting of trials.

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TABLE 1

Soil characteristics at locations of the experiments

| No. | Location | Texture | PH | C.E.C. m.e./100 gms. | Organic matter % | Total N% (Olsen's) | Available P ₂ O ₅ lbs./acre | Exchangeable cations m.e./100 gms. | | |
|-----|----------------------|-----------------|-----|----------------------------|------------------------|--------------------------|---|---------------------------------------|------------------|------------------|
| | | | | | | | | K+ | Ca ⁺⁺ | Mg ⁺⁺ |
| 1 | Govt. Farm, Mapalana | Clayloam | 6.0 | — | — | 0.25 | 63.8 | 0.26 | — | — |
| 2 | Talalla | Sandy clay loam | 5.0 | 8.5 | 2.0 | 0.10 | 22.8 | 0.04 | 1.95 | 0.87 |
| 3 | Damyella | Sandy clay loam | 4.7 | 12.0 | 6.0 | 0.30 | 26.2 | 0.16 | 2.17 | 0.65 |
| 4 | Lalpe | Sandy clay loam | 5.3 | 22.2 | 4.3 | 0.25 | 63.8 | 0.26 | 9.77 | 5.88 |
| 5 | Hathamune | Clay loam | 4.8 | 16.8 | 6.4 | 0.37 | 9.1 | 0.26 | 4.12 | 1.95 |
| 6 | Mapalana | Clay loam | 5.0 | 10.8 | 3.8 | 0.21 | 43.3 | 0.08 | 3.04 | 0.65 |
| 7 | Karagoda-Uyangoda | Clay loam | 5.1 | 16.8 | 8.2 | 0.49 | 33.1 | 0.10 | 7.60 | 1.09 |
| 8 | Pallegama | Clay loam | 5.1 | 12.0 | 6.0 | 0.33 | 65.0 | 0.12 | 1.74 | 0.65 |

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TABLE 2

Effect of potassium fertilization on yield of rice at Department of Agriculture Farm, Mapalana—Maha 1966/67 (Paddy yield—Bushels per acre)

| <i>Treatments</i> | <i>Yield</i> |
|---|--------------|
| (1) N0 K ₂ O, only N and P ₂ O ₅ | 36.6 |
| (2) 28 lbs. K ₂ O per acre as a preplant dressing plus N and P ₂ O ₅ .. | 44.7 |
| (3) 42 lbs. K ₂ O per acre as a preplant dressing plus N and P ₂ O ₅ .. | 44.5 |
| (4) 63 lbs. K ₂ O per acre as a preplant dressing plus N and P ₂ O ₅ .. | 47.0 |
| (5) 28 lbs. K ₂ O per acre as a preplant dressing and 14 lbs. K ₂ O per acre as a top dressing plus N and P ₂ O ₅ | 41.1 |
| (6) 28 lbs. K ₂ O per acre as a preplant dressing and 28 lbs. K ₂ O per acre as a top dressing plus N and P ₂ O ₅ | 45.0 |
| L. S. D. at 5 % | 4.8 |
| Coefficient of variation | 7.5 |

All plots received 39 lbs. N and 47 lbs. P₂O₅ per acre as Urea and Saphos phosphate respectively.

TABLE 3
Effect of potassium and nitrogen fertilization on yield of rice in cultivators' fields of the Matara district, Yala 1967
(Paddy yield—Bushels per acre)

| Treatments | Locations | | | | | | | Average of locations |
|--|-----------|------|------|------|------|------|------|----------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 1. K_2O , N and P_2O_5 applied according to recommendations of the Department of Agriculture* | 59.2 | 64.4 | 63.9 | 54.5 | 63.0 | 61.0 | 53.3 | 59.9 |
| 2. 42 lbs. K_2O per acre before planting and 40 lbs. N per acre as top dressings | 62.4 | 69.5 | 79.7 | 56.7 | 72.1 | 90.7 | 57.3 | 69.8 |
| 3. 63 lbs. K_2O per acre before planting and 40 lbs. N per acre as top dressings | 65.9 | 70.0 | 81.1 | 67.1 | 72.9 | 90.4 | 70.4 | 74.0 |
| 4. 42 lbs. K_2O per acre before planting; 40 lbs. N and 21 lbs. K_2O per acre as top dressings | 62.8 | 87.5 | 82.7 | 64.1 | 73.9 | 94.9 | 73.7 | 77.1 |
| 5. 42 lbs. K_2O per acre before planting and 60 lbs. N per acre as top dressings | 71.7 | 83.7 | 83.1 | 68.8 | 73.9 | 90.9 | 74.4 | 78.1 |
| 6. 63 lbs. K_2O per acre before planting and 60 lbs. N per acre as top dressings | 70.5 | 87.1 | 88.9 | 67.7 | 89.1 | 92.5 | 65.3 | 80.2 |
| 7. 42 lbs. K_2O per acre before planting; 60 lbs. N and 21 lbs. K_2O per acre as top dressings | 68.3 | 86.8 | 81.1 | 66.8 | 86.9 | 85.0 | 62.6 | 76.8 |
| L.S.D. at 0.1% | .. | .. | .. | .. | .. | .. | .. | 9.9 |
| L.S.D. at 1.0% | .. | .. | .. | .. | .. | .. | .. | 7.6 |
| L.S.D. at 5.0% | .. | .. | .. | .. | .. | .. | .. | 5.6 |
| Coefficient of Variation.. | .. | .. | .. | .. | .. | .. | .. | 7.04% |

*Recommendations of the Department of Agriculture:—Locations 1 and 2 received 26 lbs. N, 48 lbs. P_2O_5 and 28 lbs. K_2O per acre as urea, saphosphate and muriate of potash respectively. Locations 3 to 7 received 39 lbs. N, 48 lbs. P_2O_5 and 42 lbs. K_2O per acre in the same forms of fertilizers as above.

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TABLE 4
Effect of fertilizer treatments with different potassium contents on yield of rice in cultivators' fields of the Matara District, Yala 1967
(Paddy yield—Bushels per acre)

| Treatments | Locations | | | | | | | Average of locations |
|--|-----------|------|------|------|------|------|------|----------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| 1. No. K ₂ O, N or P ₂ O ₅ fertilizers .. | 43.7 | 56.6 | 50.4 | 42.8 | 46.9 | 52.6 | 40.4 | 47.6 |
| 2. K ₂ O, N and P ₂ O ₅ applied according to recommendations of the Department of Agriculture* .. | 59.5 | 69.4 | 63.7 | 58.9 | 64.4 | 67.1 | 53.1 | 62.3 |
| 3. 45 lbs. each of K ₂ O, and N P ₂ O ₅ per acre applied as (15-15-15) granular compound fertilizer at sowing or planting .. | 52.2 | 80.4 | 80.1 | 79.6 | 70.5 | 87.8 | 68.2 | 74.1 |
| 4. 45 lbs. each of K ₂ O, N and P ₂ O ₅ per acre applied as (15-15-15) granular compound fertilizer four weeks after sowing or one week after planting .. | 53.6 | 91.1 | 76.6 | 77.6 | 72.1 | 84.8 | 61.9 | 74.0 |
| 5. 18 lbs. K ₂ O, 45 lbs. each of N and P ₂ O ₅ and 12 lbs. MgO per acre applied as (15-15-6-4) granular-compound-fertilizer at sowing or planting .. | 56.6 | 68.9 | 66.2 | 68.9 | 67.7 | 87.1 | 55.3 | 67.2 |
| 6. 18 lbs. K ₂ O, 45 lbs. each of N and P ₂ O ₅ and 12 lbs. MgO per acre applied as (15-15-6-4) granular compound-fertilizer four weeks after sowing or one week after ploughing .. | 48.1 | 72.1 | 67.1 | 67.7 | 68.9 | 69.3 | 51.5 | 63.5 |
| L.S.D. at 0.1% | .. | .. | .. | .. | .. | .. | .. | 10.3 |
| L.S.D. at 1.0% | .. | .. | .. | .. | .. | .. | .. | 7.8 |
| L.S.D. at 5.0% | .. | .. | .. | .. | .. | .. | .. | 5.8 |
| Coefficient of Variation .. | .. | .. | .. | .. | .. | .. | .. | 8.2% |

*Recommendations of the Department of Agriculture :

Location 1 and 2 received 26 lbs. N, 48 lbs. P₂O₅ and 28 lbs. K₂O per acre as Urea. Saphosphosphate and Muriate of Potash respectively. Locations 3 to 7 received 39 lbs. N, 48 lbs. P₂O₅ and 42 lbs. K₂O per acre in the same forms of fertilizer as above.

TABLE 5

Frequency distribution (%) of exchangeable potassium in the top soils of
134 samples from rice fields of Matara District

| <i>m.e.K+ per 100 gm. soil</i> | | | % |
|------------------------------------|----|----|------|
| >0.30 | .. | .. | 9.7 |
| 0.26-0.30 | .. | .. | 14.9 |
| 0.21-0.25 | .. | .. | 5.2 |
| 0.16-0.20 | .. | .. | 11.9 |
| 0.10-0.15 | .. | .. | 25.4 |
| < 0.10 | .. | .. | 32.8 |

RESPONSE OF RICE TO POTASSIUM FERTILIZER IN THE MATARA DISTRICT

TABLE 6.—Economics of the use of potassium and nitrogen fertilizers in the Matara district (Yala 1967)

| Treatments | Cost of Fertilizer Rs. c. | Average yield Bus/acre | Yield Increase | | Total Net Income Rs. c. | Net Return Rs. c. |
|--|------------------------------|---------------------------|----------------|------------|----------------------------|----------------------|
| | | | Bushels | Percentage | | |
| 1. K ₂ O, N and P ₂ O ₅ applied according to the recommendations of the Department of Agriculture | 45 54 | 59.9 | — | — | 793 06 | — |
| 2. 42 lbs. K ₂ O per acre before planting and 40 lbs. N per acre as top dressings | 46 34 | 69.8 | 9.9 | 16.5 | 931 06 | 92 46 |
| 3. 63 lbs. K ₂ O per acre before planting and 40 lbs. N per acre as top dressings | 51 06 | 74.0 | 14.1 | 23.5 | 984 94 | 146 34 |
| 4. 42 lbs. K ₂ O per acre before planting ; 40 lbs. N and 21 lbs. K ₂ O per acre as top dressings | 51 06 | 77.1 | 17.2 | 28.7 | 1,028 34 | 189 74 |
| 5. 42 lbs. K ₂ O per acre before planting and 60 lbs. N per acre as top dressings | 56 04 | 78.1 | 18.2 | 30.4 | 1,037 36 | 198 76 |
| 6. 63 lbs. K ₂ O per acre before planting and 60 lbs. N per acre as top dressings | 61 06 | 80.2 | 20.3 | 33.9 | 1,061 74 | 223 14 |
| 7. 42 lbs. K ₂ O per acre before planting ; 60 lbs. N per and 21 lbs. K ₂ O per acre as top dressings | 61 06 | 76.8 | 16.9 | 28.2 | 1,014 14 | 175 54 |

TABLE 7.—Economics of the use of granular-compound-fertilizers of different potassium contents in the Matara district (Yala 1967)

| Treatments | Cost of Fertilizer Rs. c. | Yield Bus/acre | Yield Increase | | Total Net Income Rs. c. | Net Return Rs. c. |
|--|------------------------------|-------------------|----------------|------------|-------------------------------|-------------------------|
| | | | Bushels | Percentage | | |
| 1. No Fertilizers | — | 47.6 .. | — | — | 666 40 .. | — |
| 2. Straight fertilizers applied according to recommendations of the Department of Agriculture | 45.54 .. | 62.3 .. | 14.7 .. | 31.0 .. | 826 66 .. | 160 26 |
| 3. Granular-compound-fertilizer (15-15-15) at 300 lbs. per acre applied at planting | 64.35 .. | 74.1 .. | 26.5 .. | 55.7 .. | 973 05 .. | 306 65 |
| 4. Granular-compound-fertilizer (15-15-15) at 300 lbs. per acre applied 4 weeks after sowing or one week after planting | 64.35 .. | 74.0 .. | 26.4 .. | 55.5 .. | 971 65 .. | 305 25 |
| 5. Granular-compound-fertilizer (15-15-6-4) at 300 lbs. per acre applied at planting | 64.35 .. | 67.2 .. | 19.6 .. | 41.2 .. | 876 45 .. | 210 05 |
| 6. Granular-compound-fertilizer (15-15-6-4) at 300 lbs. per acre applied 4 weeks after sowing or one week after planting | 64.35 .. | 63.5 .. | 15.9 .. | 33.4 .. | 824 65 .. | 158 25 |