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**CATTLE AND POULTRY MANURE AS SOURCES OF  
PHOSPHORUS AND POTASSIUM FERTILIZER**

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In the intensively vegetable growing regions of Sri Lanka farmers commonly add large amounts of cattle and poultry manure for the cultivation of high value crops. In the Nuwara Eliya region for instance the common practice is to grow two crops of potato in rotation with a vegetable, each potato crop receiving about 30 t/ha fresh cattle manure, which is really dung mixed with bedding material such as straw and grass. In addition, abundant amounts of chemical fertilizers are added to all three crops. On the basis of that fresh

(P= Phosphorus, K= Potassium)

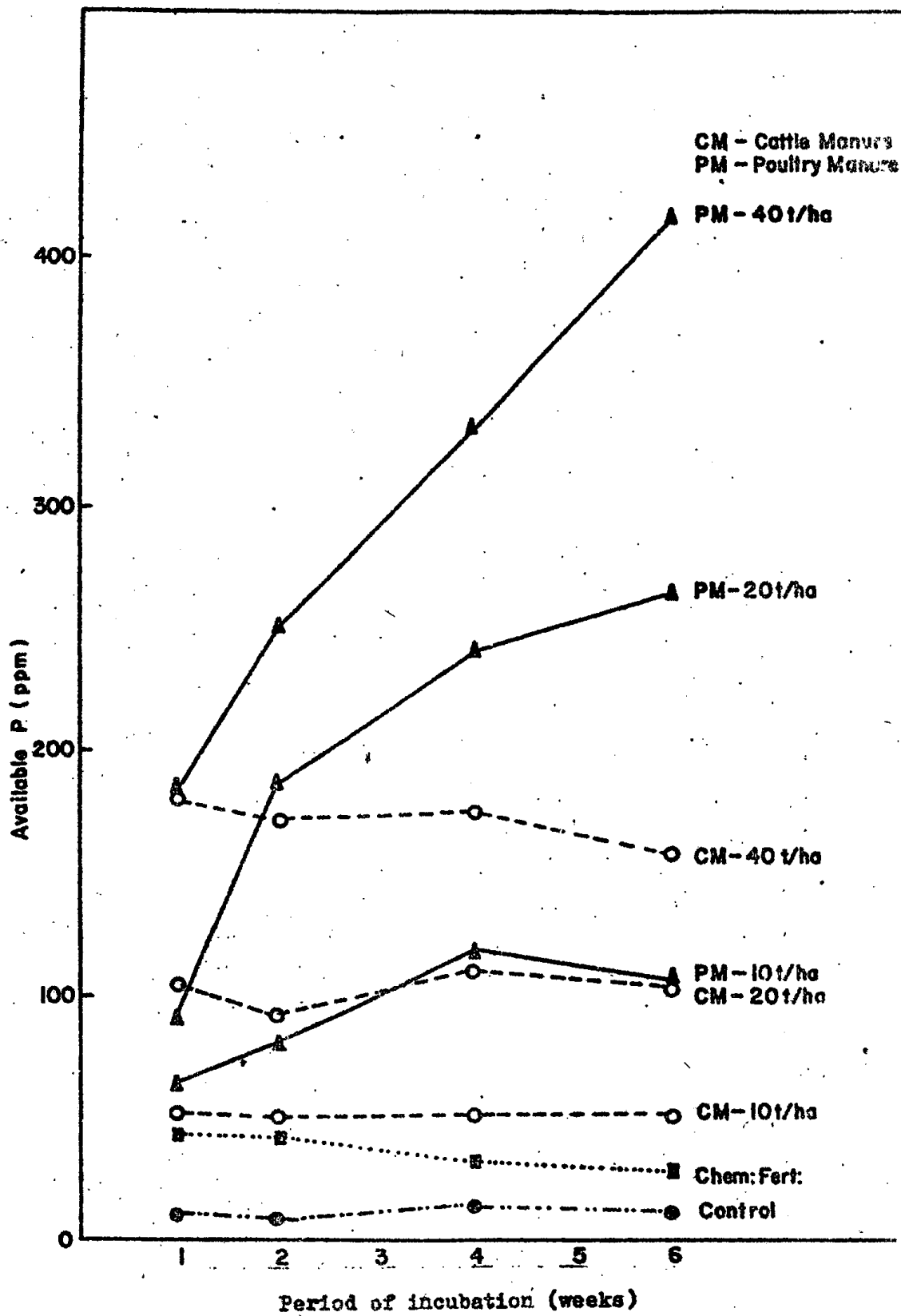
cattle manure contains on the average 0.1% P and 0.4% K, the above rate of manure application would result in the addition of 60 kg P and 240 kg.K, per hectare every year. However, farmers seldom give any consideration to the plant nutrients contained in these manures when adding chemical fertilizers. Perhaps low fertilizer prices and high profits from vegetable cultivation do not necessitate such consideration. Consequently, the soil P and K levels of these soils are extremely high when compared to the uncultivated soils in this region or even to the tea growing soils. In order to control the build up of soil P and K to such high levels, which could be harmful to the soil, farmers should be advised on how to adjust chemical fertilizer rates when organics are also being used. At present such information is lacking. This study was undertaken to compare the effects of chemical fertilizer and animal wastes, when incubated with soil, on available P and exchangeable K content.

Soil was mixed with cattle and poultry manure at rates of 10, 20 and 40 t/ha, and incubated at about 75% field capacity for six weeks. The soil used in this study was a sandy loam having a pH of 7.4, Olsen P value of 15 ppm and an exchangeable K content of 0.48 <sup>me</sup> ~~cm~~ /100g. Table 1 gives the analyses of the manures used. The manure treatments were compared with a control and a chemical fertilizer treatment of 0.9 t/ha of a 16-20-12 mixture of urea, triple superphosphate and muriate of potash. This is one and a half times the recommendation of the Department of Agriculture for fruit vegetables such as tomato. Soil samples were taken periodically and analysed for available P and exchangeable K content by standard analytical methods.

Table 1. Analysis of manures

Manure	Total nutrient % (dry basis)		
	N	P	K
Cattle	1.23	0.33	0.76
Poultry	2.75	1.68	2.47

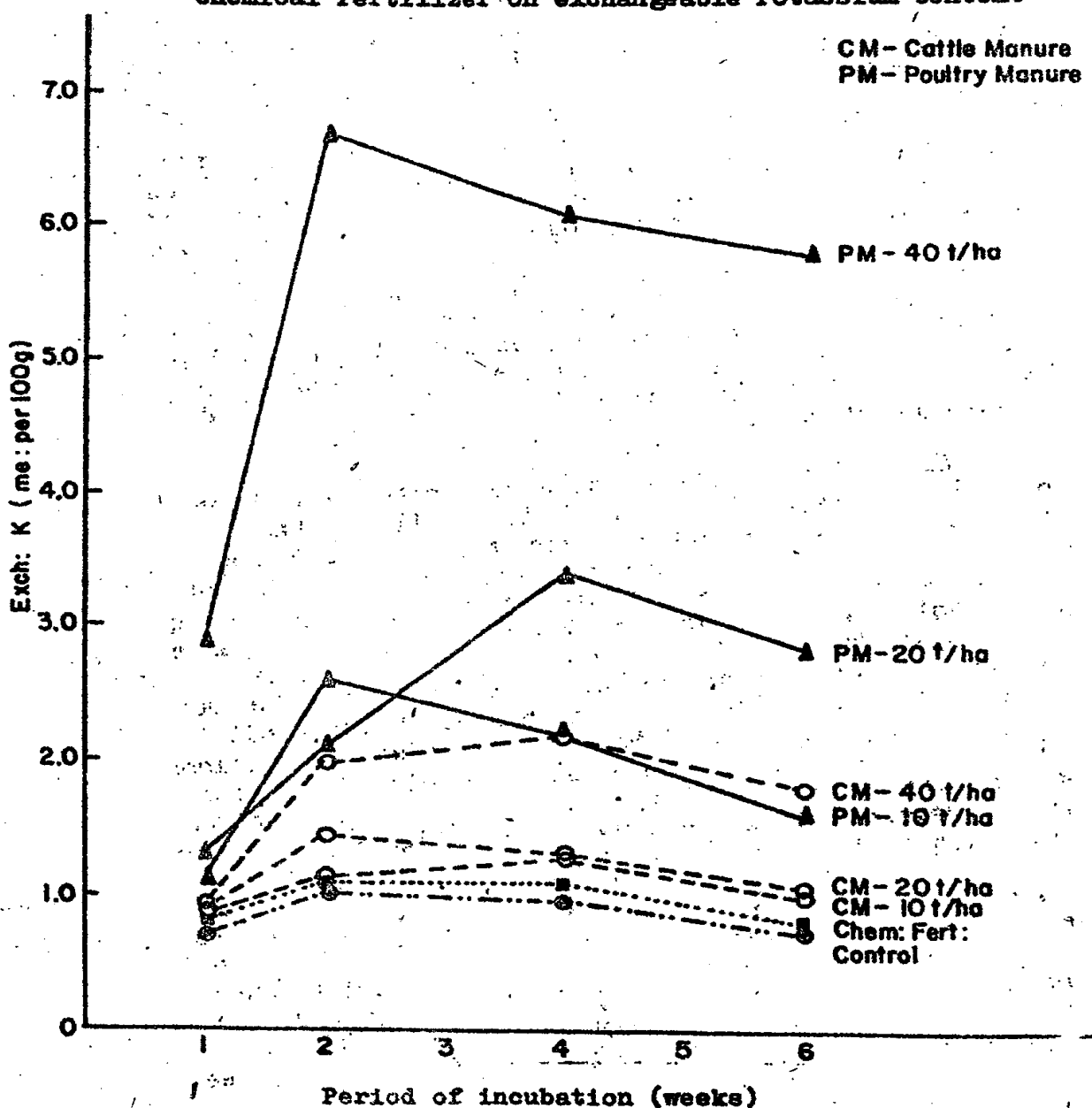
Figure 1 - Effect of incubating soil with animal wastes and chemical fertilizer on available Phosphorus content



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Incubating soil with cattle manure and poultry manure led to increases in available soil P content (Fig.1). The cattle manure and chemical fertilizer treatments did not show a significant change in available P content with incubation time. One may perhaps conclude from Figure 1 that the P in cattle manure seems to be readily available. In contrast the P in poultry manure seems to be released gradually. These results suggest that poultry manure contains a slow release type of P while that in cattle manure is of a high release type, the description being relative.

Figure 2 - Effect of incubating soil with animal wastes and chemical fertilizer on exchangeable Potassium content



**Potassium** The exchangeable soil K content increased with the addition of cattle and poultry manures (Fig.2). For both manures, soil K levels established after about 4 weeks. Hence it may be concluded that most of the K in cattle and poultry manure is made available by about this time.

**Comparison of animal wastes and chemical fertilizer in influencing available P and exchangeable K content.**

Addition of chemical fertilizer, cattle manure and poultry manure led to increase of available P and exchangeable K in the soil. The increase obtained after six weeks of incubation over the control expressed as a percentage of nutrient added is shown in Table 2. The data show that cattle manure and triple superphosphate brought about similar percent increases, while with poultry manure the increase was lower. It must be remembered however, that these comparisons are made at unequal levels of P added to soil. 40 t/ha poultry manure adding about 50 times as much P as that added by TSP. It must also be remembered that animal wastes may cause increase in available soil P by various chemical and biological means, so that the effect seen may not be attributed only to the P added by the animal wastes. Yet, it may not be erroneous to conclude that under the conditions of this experiment, both cattle manure and poultry manure are very good sources to increase available P content of soil.

Cattle and poultry manure have both shown higher percent increases in exchangeable soil K than that from muriate of potash. Here too, the amounts of K added by the three sources are vastly different.

Muriate of potash was added at the rate of 42 mg K/kg soil, whereas in the animal waste treatments several times more K were added. The relatively low percent increase from muriate of potash may be due to the low rate of addition which could have resulted in the tying up of some K in non-exchangeable positions. When large amounts of K are added as with the animal waste treatments, most of the non-exchangeable sites may be saturated, thereby leading to a higher percentage of exchangeable K in soil.

The above demonstrates that animal wastes are good sources in increasing available soil P and exchangeable K in soil. The fact that they caused these increases in a short period of time suggests that much of the P and K in them may be available to a crop during the season of application itself. Rates of release will however, depend on soil temperature, moisture, aeration, soil microbial regime and its activity. Field experiments should be conducted to learn more about these transformations and thereby to bring about the best combination of chemical and organic fertilizers.

**Table 2 - Effect of addition of chemical fertiliser, cattle manure and Poultry manure on increase in available P and exchangeable K content of soil.**

Treatment	1	2	3	4
Chemical Fertilizer	36.6	41.3	41.9	28.0
Cattle manure - 10 t/ha	89.7	44.6	206.5	37.3
Cattle manure - 20 t/ha	179.3	53.4	413.0	29.2
Cattle manure - 40 t/ha	358.6	45.4	826.0	54.7
Poultry manure - 10 t/ha	456.5	23.2	671.1	49.2
Poultry manure - 20 t/ha	912.9	29.1	1342.2	63.1
Poultry manure - 40 t/ha	1825.8	25.2	2684.4	81.3

1 = Quantity of P added, mg/kg soil  
 2 =  $\frac{\text{Increase in avail. P}}{\text{Quantity of P added}} \times 100$   
 3 =  $\frac{\text{Quantity of K added}}{\text{mg/kg soil}}$

4 =  $\frac{\text{Increase in Exch. K}}{\text{Quantity of K added}} \times 100$

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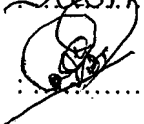
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