

## DEVELOPMENT OF A TWO WHEEL TRACTOR DRIVEN COCONUT FERTILIZER APPLICATOR

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Coconut (*Cocos nucifera* L.) is a perennial tree crop with about 60 years of economic life span. Declining soil fertility over several decades due to inadequate replenishment of the exhausted nutrients is a major problem affecting the coconut production. The annual yield from a single tree can be increased up to 100-125 nuts, from 50-70 nuts with the application of fertilizer<sup>1</sup>. Currently, fertilizer is applied manually, consuming more time and increased cost of production. Furthermore, the amount of fertilizer applied per palm could vary due to incorrect measurements. Unfortunately, there is no efficient method to apply fertilizer in coconut estates. Thus the general objective of this study was to introduce an efficient method for applying fertilizer in coconut estates. The specific objectives were; to design and develop a fertilizer applicator operated by a two-wheel tractor, to study the performance of the fertilizer applicator, and to increase the coconut production in Sri-Lanka at reduced cost, by increasing efficiency.

After investigating physical properties of raw material and its influence on the performance of fertilizer application, a two-wheel tractor driven granular fertilizer applicator was developed. The design was facilitated with the unit operations of containing fertilizer, metering mechanism, applying fertilizer, opening and closing of furrows. The main components of the applicator were hopper, opposite-direction screw conveyor, two sets of furrow openers, fertilizer tubes, and a furrow closer. Power from engine of two-wheel tractor to the applicator was transmitted by using a chain and sprockets. The fertilizer applicator was attached to the rear of the two-wheel tractor. The two furrow openers were attached to the front of the frame. The two fertilizer application tubes were attached to the back of furrow openers. The furrow closer was attached to the back of the frame. The hopper was attached to the top of the tractor, closer to the rear. This helped to properly balance the tractor movement while providing sufficient space for the hopper (Figure 1).

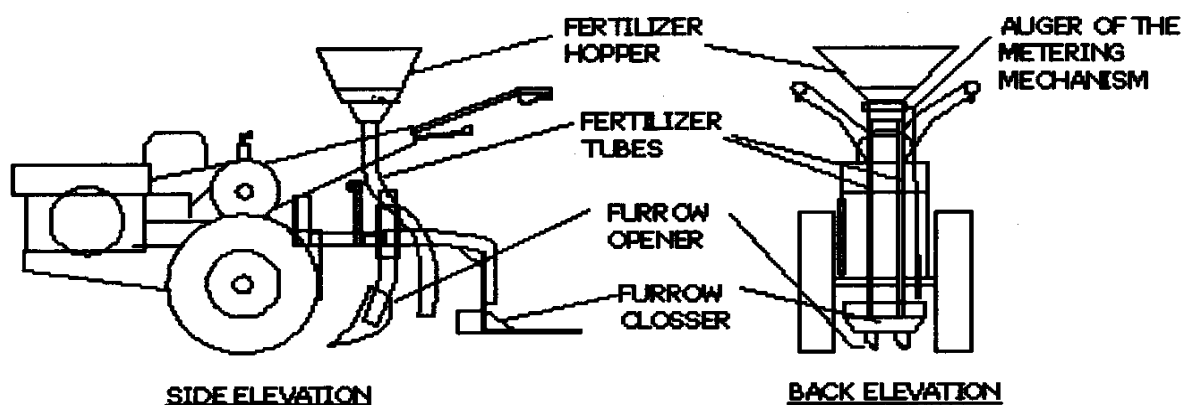
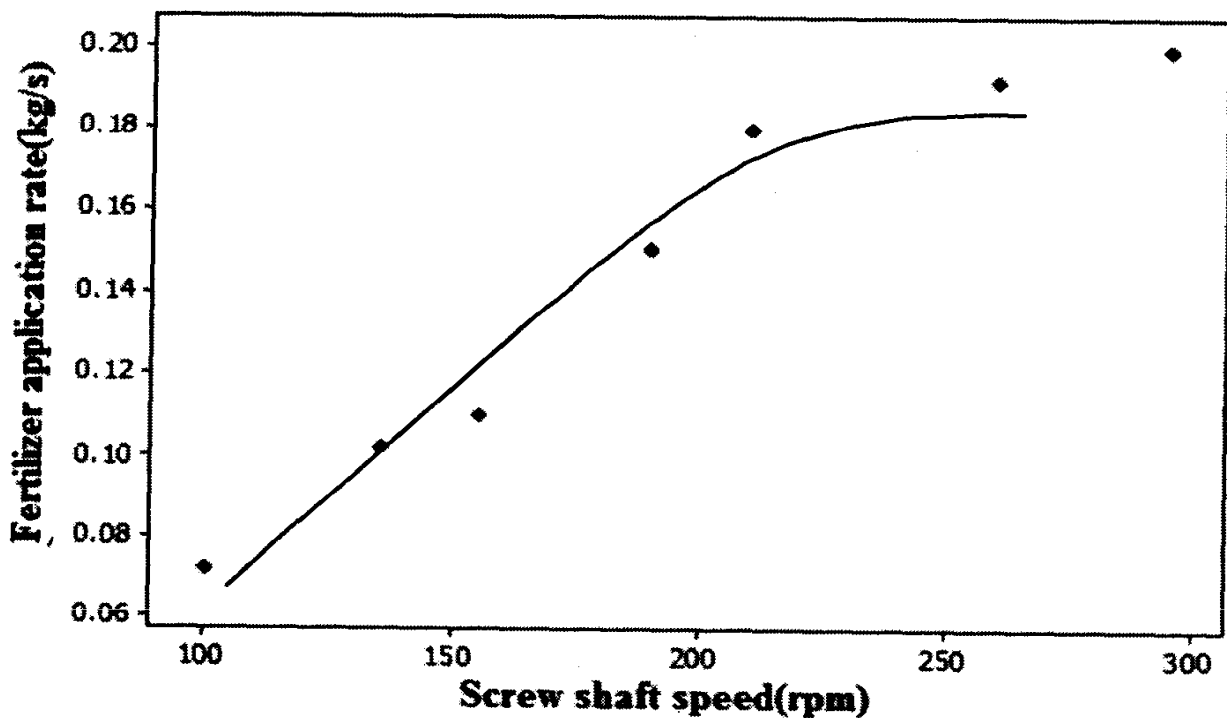


Figure 01. Isometric Side and Back Elevation of the Fertilizer Applicator

The main field operation aspects according to the RNAM (1983) test codes were; work capacity (theoretical and actual), field efficiency, and fuel consumption rate. An experiment was also carried to find the fertilizer application efficiency in the field. Time and cost required for applying fertilizer for coconut palms by this unit was compared with the traditional, manual method<sup>2</sup>. In order to develop the components of the fertilizer applicator, properties of the fertilizer mixture were investigated. The angle of repose of the fertilizer mixture was 45°. The angle of friction of the fertilizer mixture with mild steel sheet was 55° and with stainless steel sheet it was 35°. The density of fertilizer mixture was 0.9 kg/l.



**Figure 02. Fertilizer Application Rate vs. Screw Shaft Speeds**

Figure 2 shows an initial linear variation and final constant rate of the fertilizer application as a function of the tractor speed. The optimum fertilizer application rate was 0.156 kg/s. The screw shaft rpm was 204.

The fertilizer applicator was evaluated in a coconut land and received satisfactory results. The applicator was designed to apply 5 kg of fertilizer mixture per palm at an optimum speed of 1.1 km/h. It performed at a fertilizer feeding capacity of 0.45 ha/hr with 72.7 % efficiency. Compared to the traditional method, the developed fertilizer applicator could save 96.5 % of time as well as 94 % of cost in fertilizer application per hectare of coconut plantation. The fuel consumption rate was 0.75 l/h. The coconut fertilizer applicator has the potential of becoming a powerful tool in the field for the application of inorganic fertilizers.

**Key words:** *Coconut cultivation, Fertilizer applicator, Coconut fertilizer*

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