ABSTRACT

India is the world's largest producer of turmeric {*Curcuma longa* Linn.) known as 'Indian Saffron' and considered the best due to its high curcumin content. It is used in diversified industries as condiment, as flavouring and colouring agent and principal ingredient in curry powder apart from pharmaceuticals and cosmetic industry. Harvesting of turmeric rhizome is one important aspect which requires immediate attention for developing appropriate mechanical technology. Conventional method of harvesting turmeric rhizome is labour intensive, requiring skilled men labour to digout the crop. Non-availability of such skilled labour and the high wages demanded by them to harvest the crop, the higher field losses and damage to the crop by manual harvesting, necessitate the need to develop a suitable mechanical harvester for turmeric. Tractor mounted turmeric diggers developed earlier could dig out the rhizomes but separate manpower was required to collect the dug out rhizomes. The cost of collecting the harvested produce covered about 85 per cent of the labour cost in machine harvesting. Therefore, if a suitable mechanism could be developed for digging and collecting the rhizome, it could be more efficient and beneficial to farmers. With this is view, an investigation was taken up to develop an appropriate digging tool, namely, a digging blade and a soil separation and rhizome collection mechanism, which could be attached to a tractor. The various soil, crop and machine parameters were investigated to optimise the various design components of the tractor mounted turmeric harvester.

The soil parameters at the time of harvest such as soil type, soil moisture, bulk density and cone index and crop parameters such as plant population, rhizome spread (vertical and lateral), rhizome weight, number of fingers/rhizome, moisture content and bulk density of rhizomes which influence the mechanical harvesting of turmeric were analysed by standard experimental procedures.

The machine parameters namely, blade geometry and conveyor characteristics were studied and optimized by experimentation.

Based on the performance on harvesting efficiency, conveying efficiency, damage to rhizomes and minimum soil handling, the following machine parameters for the tractor mounted turmeric harvester to be operated at a forward speed of 2.5 kmph were optimised and selected.

- Straight blade, of 10mm thick mild steel plate of 920mm width and with digging chisels(6nos) in front and guiding rakes (lOnos) behind it, as a digging tool at a rake angle of 20 deg.
- Conveyor assembly, having conveyor screen made of 10mm dia polished rots (13nos) with vaf length of 1520mm, mounted on a frame of 35 deg slope, with gear box and sprocket drive system, at a conveyor speed of 4.5kmph.

The prototype of tractor mounted turmeric harvester was evaluated in clay loam soil in farmer's fields and compared with manual harvesting under similar conditions. The field capacity was 0.16 hectare per hour and the harvesting efficiency was 98.5 per cent with damage caused to the rhizome being less than 2.30 per cent. In manual harvesting, the harvesting efficiency was 89.90 percent with damage caused to rhizome being 7.90 percent and percentage of rhizome left undug being 10.10 percent, whereas it was 1.5 percent when harvested with machine. This shows that an additional quantity of about 8.6 percent of the crop which otherwise would have been left undug, could be realised as yield and thus the field loss could be considerably reduced resulting in increased productivity.

The cost of the harvester is Rs 25000 (US $ 500) and the cost of harvesting per ha was Rs 1556 (US $ 31). The breakeven point was 29 ha per annum and the payback period was 2.30 years. The savings in cost over manual harvesting of turmeric with the harvester was 85.32 percent.