India ranks second in vegetable production. However the average yield of vegetables in India is still lower than that in many Asian countries. One of the major reasons of low productivity is the low level of mechanization. Cultivation practice that would benefit from mechanization in vegetable production is transplanting of good-quality seedlings. Since long rearing of vegetable seedlings was traditionally done by placing of seeds on raised soil beds in open field. However, over the past few years, plug tray seedling technology has gained momentum for its several advantages over nursery raising in open field. A large number of such nurseries have been operating, where seedlings are grown in plug trays and sold on pre-ordered basis to farmers. These seedlings are to be transplanted as early as possible to minimize mortality.

Transplanting of plug seedlings is a manual and labour-intensive operation. In peak season due to unavailability of labourers, timely transplanting is not possible. Besides the quantum of labour, manual transplanting involves considerable drudgery and human discomfort. Cost of labourers being increased day by day and therefore manual transplanting is becoming uneconomical. Imported vegetable transplanters have not been adopted by farmers due to their high costs and the resultant uneconomic scale of production. In view of the above investigation, the present study was undertaken to design and develop a manually operated two row trolley type vegetable transplanter for mechanizing transplanting operation. The major area under vegetable cultivation is transplanted through plug seedlings in India (Indian Horticultural Database 2015) specifically for tomato, brinjal and chilli. These crops were selected to design, develop and test the vegetable transplanter.

The morphological parameters of chilli, brinjal and tomato seedlings namely plant height and canopy of seedling were determined. The transplanter was designed on the basis of morphological parameters, agronomical requirements and ergonomical consideration for transplanting two rows (4 seedlings) at a time. The jaw is main operational part of vegetable transplanter which was fitted at the bottom of hollow delivery tubes (4 numbers) for transplanting. The foot lever penetrates the jaws into the soil by means of the pressure exerted. One seedling in each delivery tube is
dropped. Hand lever opens the jaws inside the soil and places the seedling in the pit made by the movement of jaw. Gradual release of pressure from foot lever allows the nearby soil to cover the root bulb of the seedling. This in turn compacts the root zone to required level.

The transplanter performance was observed in terms of upright plants, laying down plants, plant mortality, theoretical field capacity, effective field capacity, field efficiency, labour requirement and cost of operation. Maximum field efficiency of 86.75 per cent, 86.80 per cent and 86.68 per cent were obtained for chilli, brinjal and tomato respectively for 4 weeks age of seedlings on bare bed. Maximum upright plants were found as 75 per cent, 88.75 per cent and 86.25 per cent for 5 weeks age of chilli, brinjal and tomato seedlings on mulch bed. Minimum values of plant mortality were as 13.75 per cent, 11.25 per cent and 12.50 per cent for 5 weeks age of chilli, brinjal and tomato seedlings on mulch bed. In general effective field capacity was found as 0.014 ha/h for 6 weeks age of all three seedlings on mulch bed. Minimum labour requirement was found as 69.32 man-h/ha, 70.21 man-h/ha and 69.67 man-h/ha respectively for 6 weeks age of chilli, brinjal and tomato seedlings on mulch bed. Minimum cost of operation 3672.74 ₹/ha, 3719.94 ₹/ha and 3690.91 ₹/ha for 6 weeks age of chilli, brinjal and tomato seedlings on mulch bed. On an average the mortality were found as 1.87 per cent, 1.04 per cent and 1.46 per cent higher as compared to manual transplanting at 4, 5 and 6 weeks age of seedlings respectively. Similarly the percentage of labour saving was found as 72.33 per cent, 75.33 per cent and 74.33 per cent and the time saving of 60.33 per cent, 71 per cent and 73 per cent in transplanter as compared to manual transplanting at 4, 5 and 6 weeks age of seedlings respectively. Also the cost of operation was found to be lower by 14.85 per cent, 16.98 per cent and 16.75 per cent as compared to manual transplanting at 4, 5 and 6 weeks age of seedlings respectively. Maximum cost for transplanting 1000 seedlings using the vegetable transplanter was observed to be ₹ 114.43 as against ₹ 156.38 when done manually. Assuming an annual use of transplanter as 250 hrs, the payback period was found as 926.74 hours or 3.71 years, which was 32.07 per cent of its total expected life.