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Comparative study of inclined plate planter and different showing machine for chickpea intensification

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Abstract
The study was under taken to design and develop a Inclined Plate Planter and different sowing machine for chickpea intensification and compared for basis of cost analysis. The total operational cost of inclined plate planter was 552.75 RS/h. and field capacity of 0.45 ha/h. the compared machine was found for Y-type inclined plate planter is total operational cost is 3512.5 RS/h and field capacity was 0.01 ha/h. similarly for ridge and furrow inclined plate planter was found total operational cost 599.50 RS/h and field capacity was 0.34 ha/h and for multi-crop inclined plate planter is total operational cost is 552.75 RS/h and field capacity was 0.42 ha/h.

Keywords: Inclined plate planter, showing machine, chickpea

Introduction
Chickpea (*Cicer arietinum* L.) is the second-most important pulse crop after pigeonpea in the World for human diet and other use. It is cultivated in area of 13.54 million hectares with a total production of 13.10 million tonnes and average productivity of 967.6 kg/ha (FAO 2013). Generally broadcasting, line sowing behind the plough, dibbling are being practiced for many past year and are still used by many small and marginal farmers. Mechanization in the sowing process aids in timely completion of the field operation increases the field efficiency and economizes cost of cultivation compared to traditional method of sowing. Use of animals or tractor drawn seed drill for pulses has enabled farmers to cover large areas in short period economically. Sowing of chickpea using SCI method developed by IGKV Raipur is done manually which is time consuming, labour intensive and it fails to maintain accurate row to row and plant to plant spacing which directly affects the crop yield and also the cost involved is high. So, to mechanize and tackle the problem faced above, a planter with suitable metering mechanism can be used.

Materials and Methods
The inclined plate seed metering mechanism was designed to optimize the cell size of metering plate for picking two seeds per cell. The details of the procedure followed in the development of the optimized inclined plate metering mechanism for chickpea seeds is evaluated both in laboratory as well as in the field are discussed in this chapter. Seed metering plate and its lab setup was fabricated in workshop of Faculty of Agricultural Engineering, Raipur.

Physical characteristics of chickpea seeds
The physical dimensions were determined randomly measuring the length, width and thickness of 10 kernels of each seeds using digital type vernier callipers having least count 0.01 mm (Fig. 1). The size and shape of the seeds will be useful in deciding the size and shape of orifice of metering mechanism. chickpea seeds, used for the study.

Fig 1: Field of chickpea crop sown by ridge and furrow inclined plate planter

Fig 2: Field of chickpea crop sown by multi-crop inclined plate planter

Fig 3: Field of chickpea crop sown by Y-tube type inclined plate planter

Result and Discussion

Cost analysis developed inclined plate planter

Initial Cost of developed inclined plate planter

Cost of developed inclined plate planter/ Capital Cost = ₹ 110000/-

Following assumption was made for economic analysis

a. Expected life = 8 years
b. Working hour (H) = 250 h/year, when working hour is 8 h/day (for two crops)
c. Salvage value (S)= 10% of initial cost
d. Rate of interest = 10% per annum
e. Labour required =2
f. Diesel cost = 70 ₹/l
g. Fuel consumption = 3.5 l/h
h. Lubrication cost = 20% of fuel cost
i. Repair and maintenance = 5% of initial cost
j. Shelter, insurance and tax cost = 2% of initial cost
k. Labour cost = 281 Rs/day

Fixed cost

Depreciation cost

D = Depreciation per hour
C = Capital investment
S= Salvage value, 10% of initial cost
H = Number of working hour per year
L = Life of machine in year = $\frac{110000-11000}{8\times250}$= Rs. 49.50

Interest

Insurance and taxes are against the losses in many farm machinery and equipment.

$= \frac{110000+11000}{2} \times \frac{0.1}{250}$ = 24.20 ₹/h

Shelter, insurance and tax cost

Shelter is necessarily required against the weather changes. Shelter cost has been calculated at 2% of the average purchase price.

$Sc = \frac{1.1P}{2} \times \frac{is}{100} = \frac{110000\times2}{250\times100}$ = 8.8 ₹/h

Then, Total fixed cost = (49.50 + 24.20+ 8.8) = 82.5 ₹/h

Variable cost

Fuel cost

Fuel cost /h
Diesel
Cost = 70 ₹/l
Fuel consumption is 4.5 l/h
= 315.00 ₹/h

Lubrication cost

Lubrication cost = 20% of fuel cost
= 315×0.20 = 63 ₹/h

Repair and maintenance cost

Repair and maintenance @ 5% of initial cost

= $\frac{110000\times5}{250\times100}$= 22.00 ₹/h

Labour charge

= 281 ₹/day
Labour required = 2
Actul field capacity = 0.44
Totalhour for one hectare = 1/0.44
Labour cost= 70.25 ₹/h

Total variable cost = 315.00+63.00+22.00+70.25= 470.25 ₹/h
Total cost of weeding = fixed cost + variable cost
= 82.5 + 470.25
= 552.75 ₹/h
Average effective field capacity = 0.45 ha/h
Cost of operation of planter = 552.75/0.45
= 1228.33 ₹/ha

Table 1: Cost of operation of developed inclined plate planter

Particulars	Values
Fixed cost	
Depreciation cost, ₹/h	49.50
Insurance cost, ₹/h	24.20
Tax + housing cost, ₹/h	8.8
Total fixed cost, ₹/h	82.5
Variable cost	
Fuel cost, ₹/ha	315.00
Lubrication cost,₹/h	63.00
Repair and maintenance cost, ₹/h	22
Labour required	2
Labour charges, ₹/h	70.25
Total variable cost, ₹/h	470.25
Total operational cost, ₹/h	552.75
Field capacity, ha/h	0.45
Total operational cost, ₹/ha	1228.33

Cost analysis of Y-tube type inclined plate planter

Initial cost of Y-tube type inclined plate planter = Rs. 110000/-

Depreciation, interest, shelter and all variable cost were calculated by similar method used to calculated cost of operation of developed inclined plate planter by taking all assumption same.

Table 2: Cost of operation of Y-tube type inclined plate planter

Particulars	Values
Fixed cost	
Depreciation cost, ₹/h	49.50
Insurance cost, ₹/h	24.20
Tax + housing cost, ₹/h	8.8
Total fixed cost, ₹/h	82.5
Variable cost	
Fuel cost, ₹/ha	315.00
Lubrication cost,₹/h	63.00
Repair and maintenance cost, ₹/h	22
Labour required	2
Labour charges, ₹/h	70.25
Total variable cost, ₹/h	470.25
Total operational cost, ₹/h	552.75
Field capacity, ha/h	0.44
Total operational cost, ₹/ha	1256.25

Cost analysis of manually sowing method

Table 3: Cost of operation of manually sowing method

Particulars	Values
Variable cost	
Labour required	1
Labour charges, ₹/h	35.125
Total variable cost, ₹/h	35.125
Total operational cost, ₹/h	35.125
Field capacity, ha/h	0.01
Total operational cost, ₹/ha	3512.50

Cost analysis of ridge and furrow inclined plate planter

Initial cost of ridge and furrow inclined plate planter = Rs. 115000 /-

Depreciation, interest, shelter and all variable cost were calculated by similar method used to calculated cost of operation of developed inclined plate planter by taking all assumption same.

Table 4: Cost of operation of ridge and furrow inclined plate planter

Particulars	Values
Fixed cost	
Depreciation cost, ₹/h	51.75
Insurance cost, ₹/h	25.30
Tax + housing cost, ₹/h	9.20
Total fixed cost, ₹/h	86.25
Variable cost	
Fuel cost, ₹/ha	350.00
Lubrication cost,₹/h	70.00
Repair and maintenance cost, ₹/h	23.00
Labour required	2
Labour charges, ₹/h	70.25
Total variable cost, ₹/h	513.25
Total operational cost, ₹/h	599.50
Field capacity, ha/h	0.34
Total operational cost, ₹/ha	1763.24

Cost analysis of multi-crop inclined plate planter

Initial cost of multi-crop inclinedplate planter = Rs. 110000 /-

Depreciation, interest, shelter and all variable cost were calculated by similar method used to calculated cost of operation of developed inclined plate planter by taking all assumption same.

Table 5: Cost of operation of multi-crop inclinedplate planter

Particulars	Values
Fixed cost	
Depreciation cost, ₹/h	49.50
Insurance cost, ₹/h	24.20
Tax + housing cost, ₹/h	8.8
Total fixed cost, ₹/h	82.5
Variable cost	
Fuel cost, ₹/ha	315.00
Lubrication cost, ₹/h	63.00
Repair and maintenance cost, ₹/h	22
Labour required	2
Labour charges, ₹/h	70.25
Total variable cost, ₹/h	470.25
Total operational cost, ₹/h	599.50
Field capacity, ha/h	0.34
Total operational cost, ₹/ha	1763.24

Summary and Conclusion: the comparison study found that the inclined plate planter for chickpea seeds are more economical and time saving machine as compare to the other sowing machine of chickpea seeds.

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