

1 Introduction

- ❑ The yield of onion in India is only **16.78 t/ha** (from a cultivation area 1.28 Mha) which is much lesser compared to the yields of USA (56.40 t/ha, from a cultivation area 0.05 Mha) and Iran (37.95 t/ha, from a cultivation area 0.06 Mha).
- ❑ One of the reasons for this lesser yield of onion is the **traditional harvesting methods** followed using manual labor resulting in a huge amount of produce getting wasted.
- ❑ More than **75%** farmer belongs to marginal and small category of land holding.
- ❑ Non availability of commercial onion harvester (e.g. **topper and diggers**) for **small land holding farmers**.



(a) Digging of onion bulbs by hand

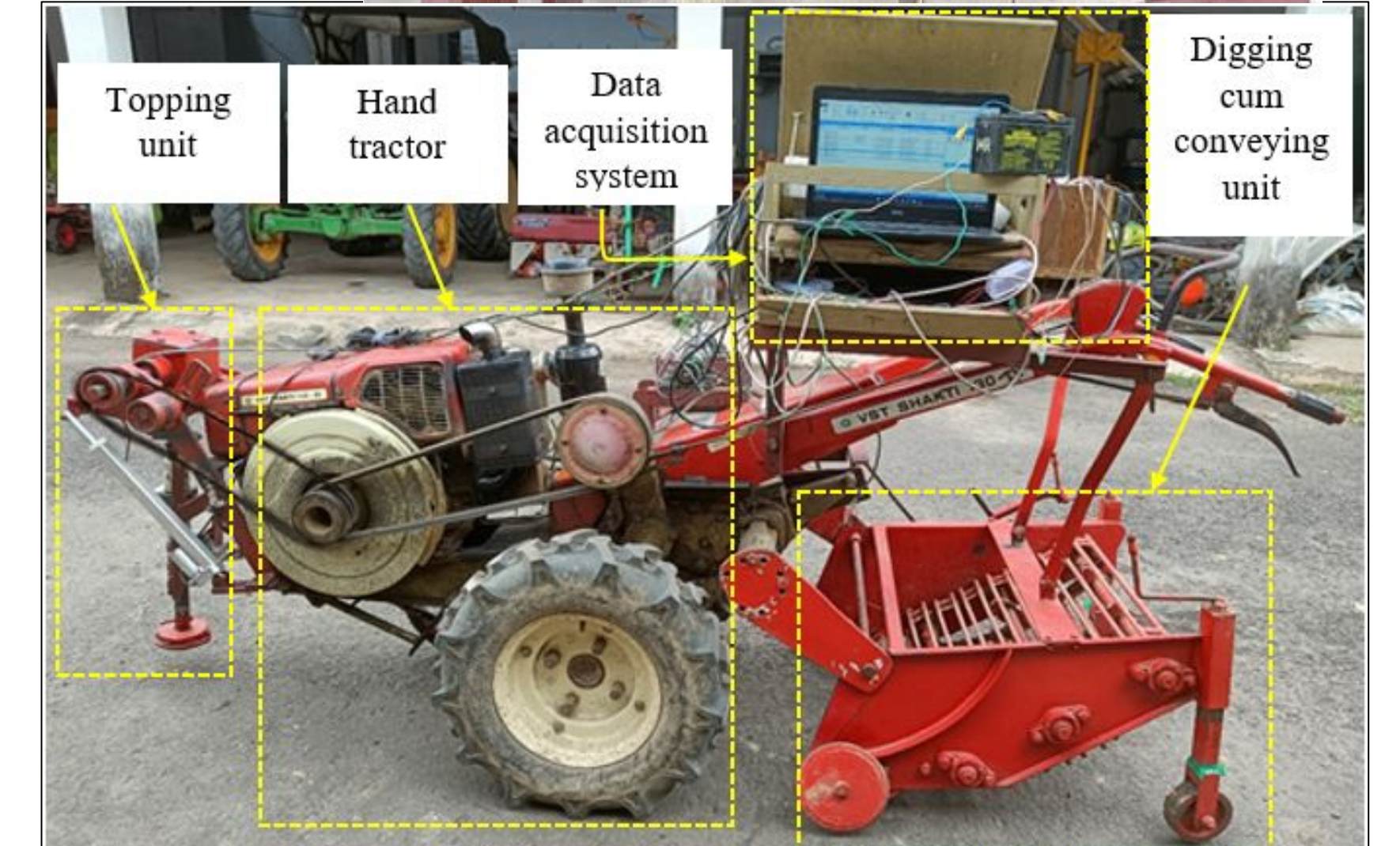
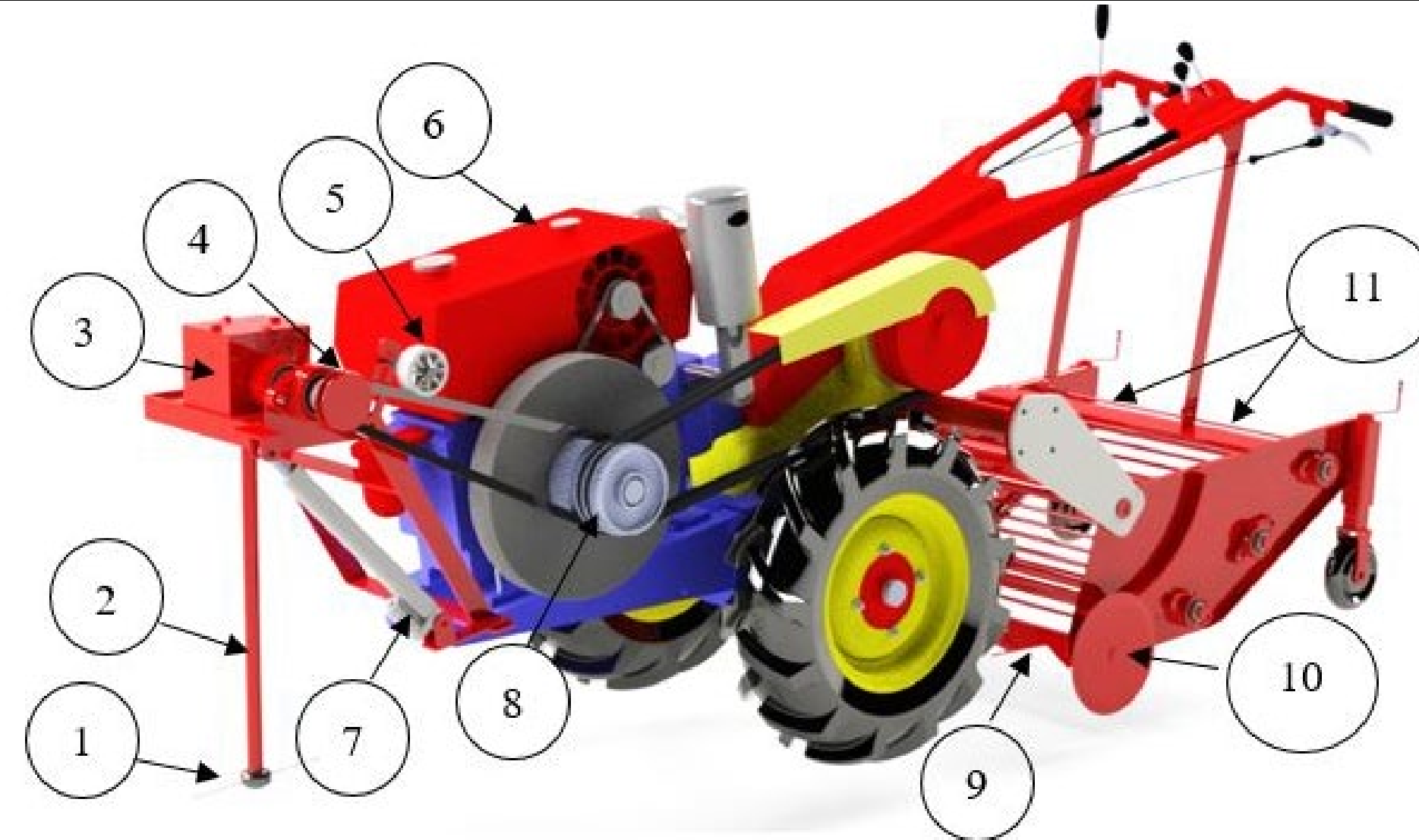
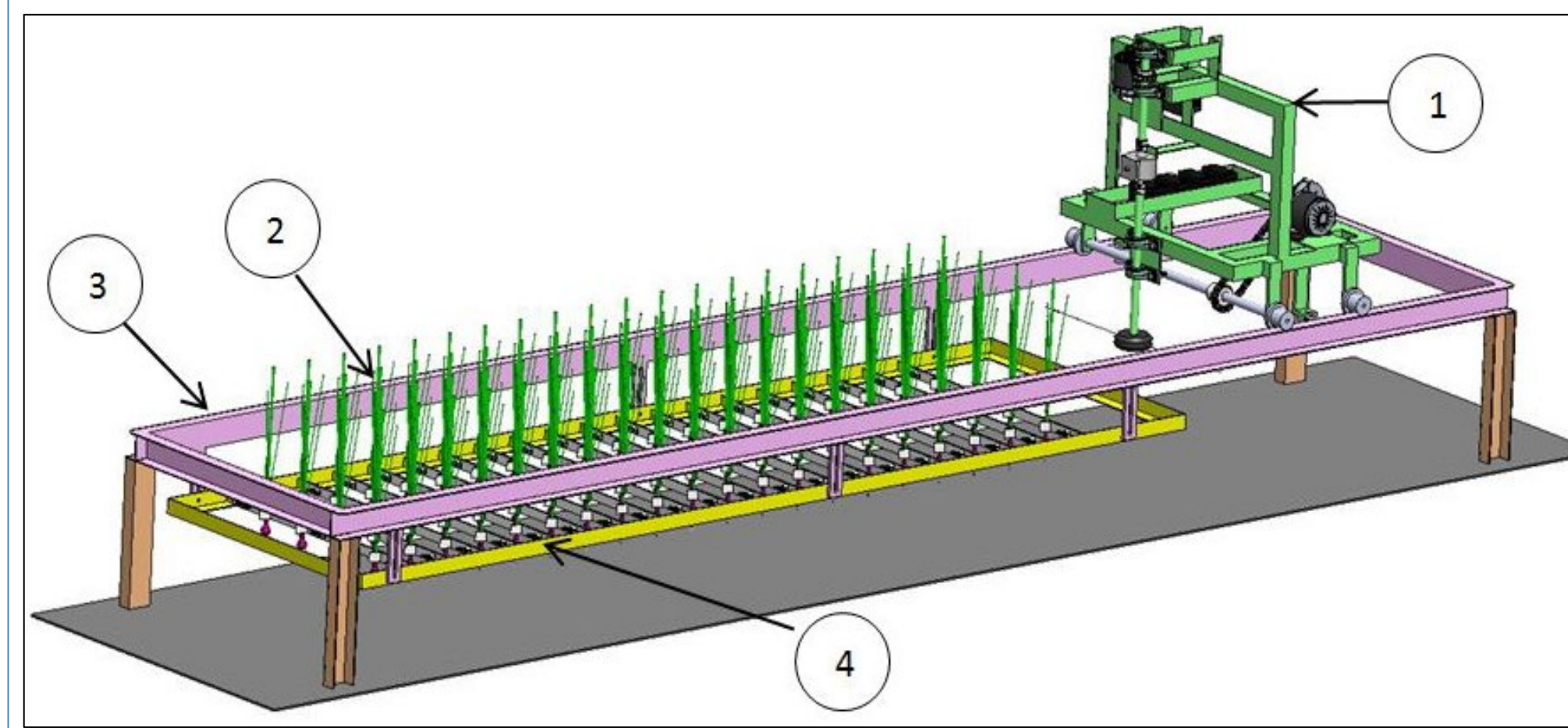


(b) Manual cutting of onion leaves

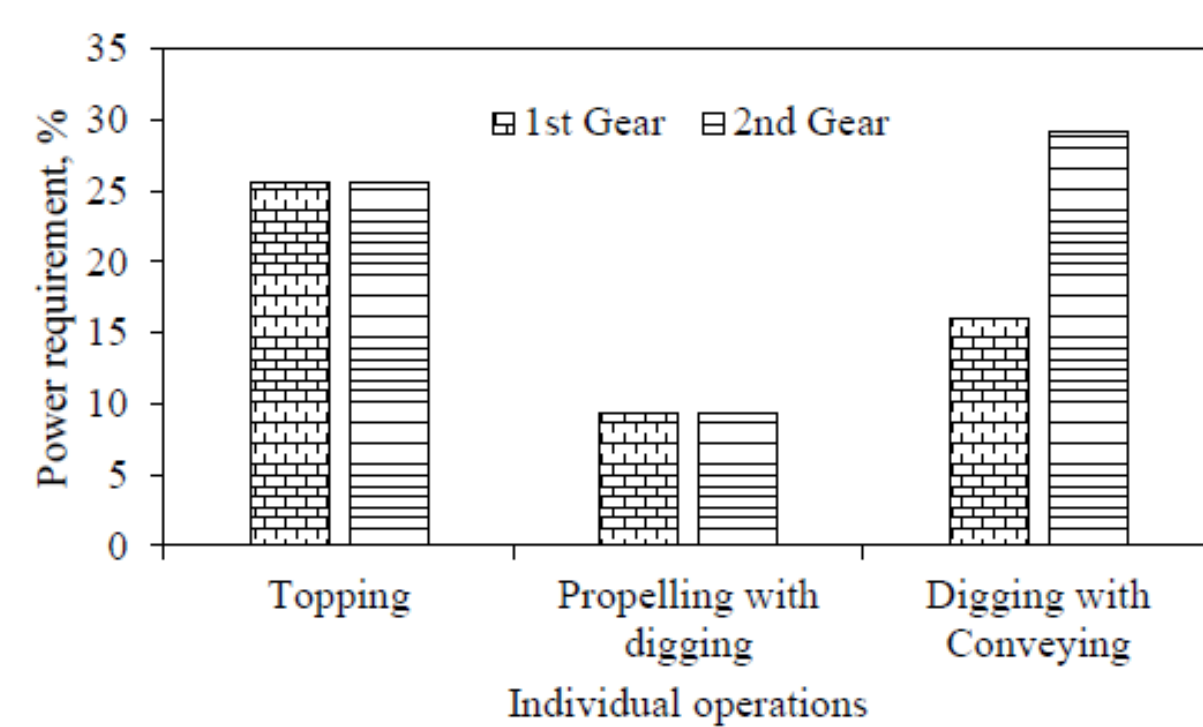
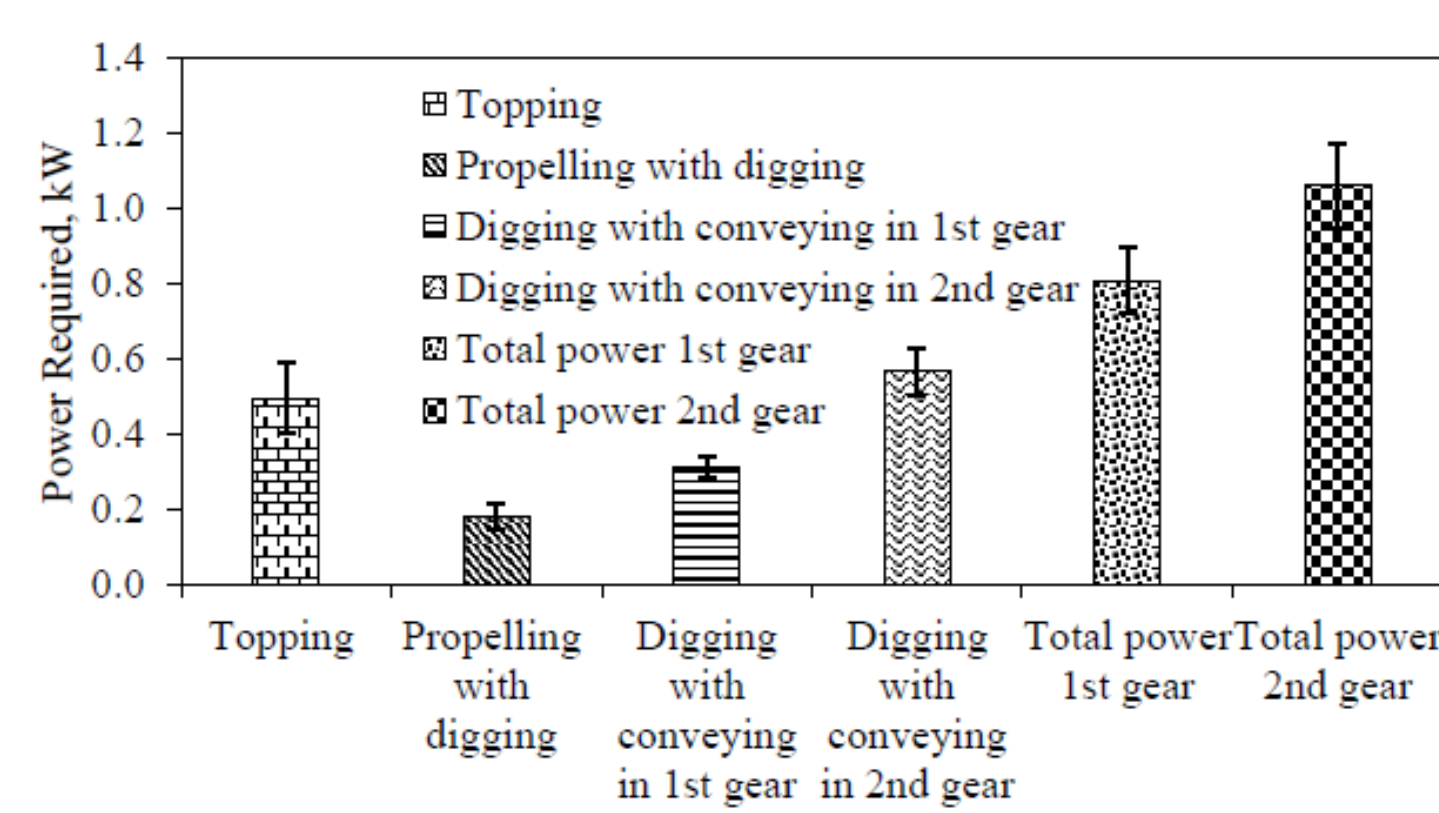
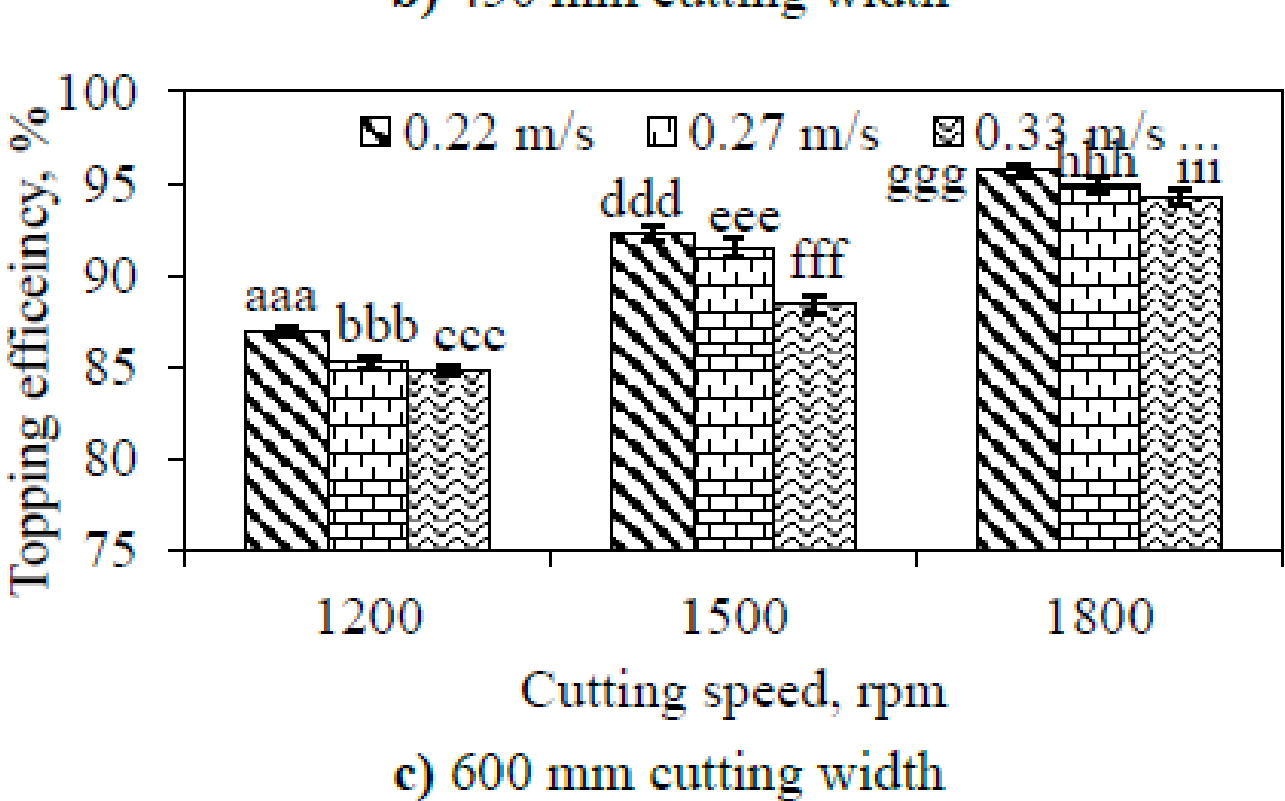
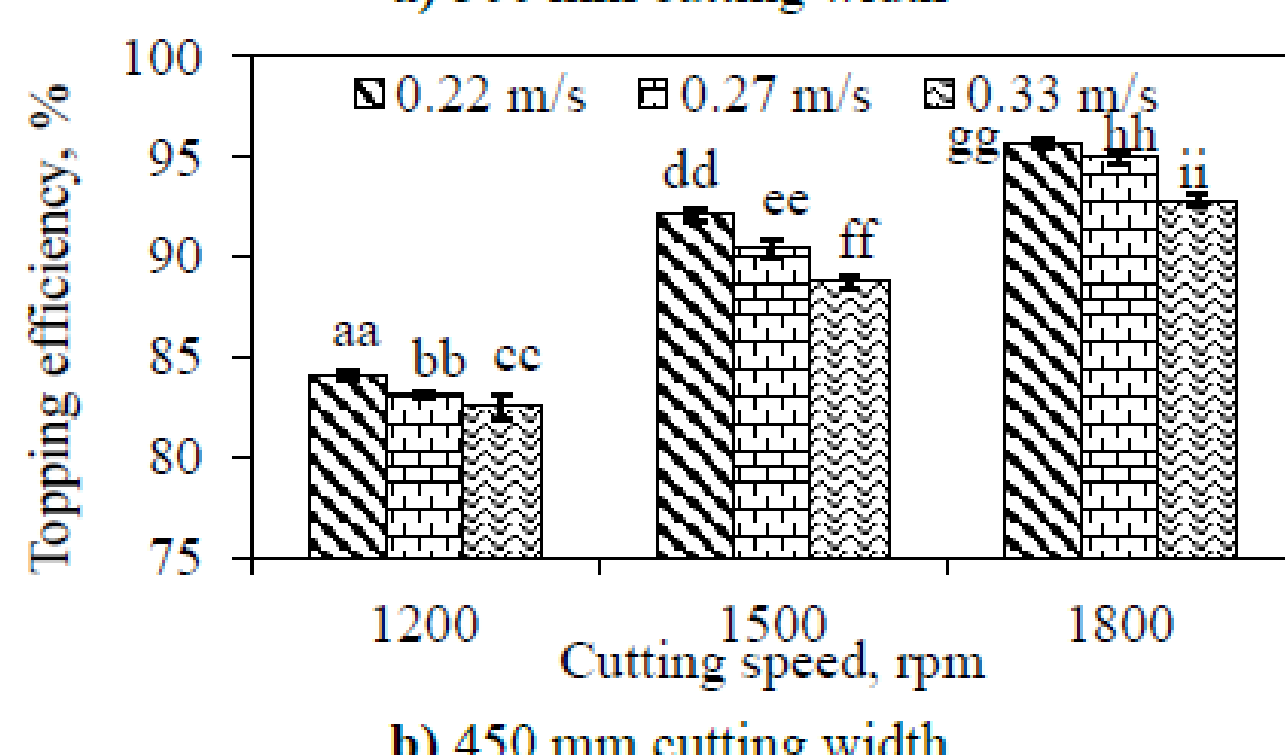
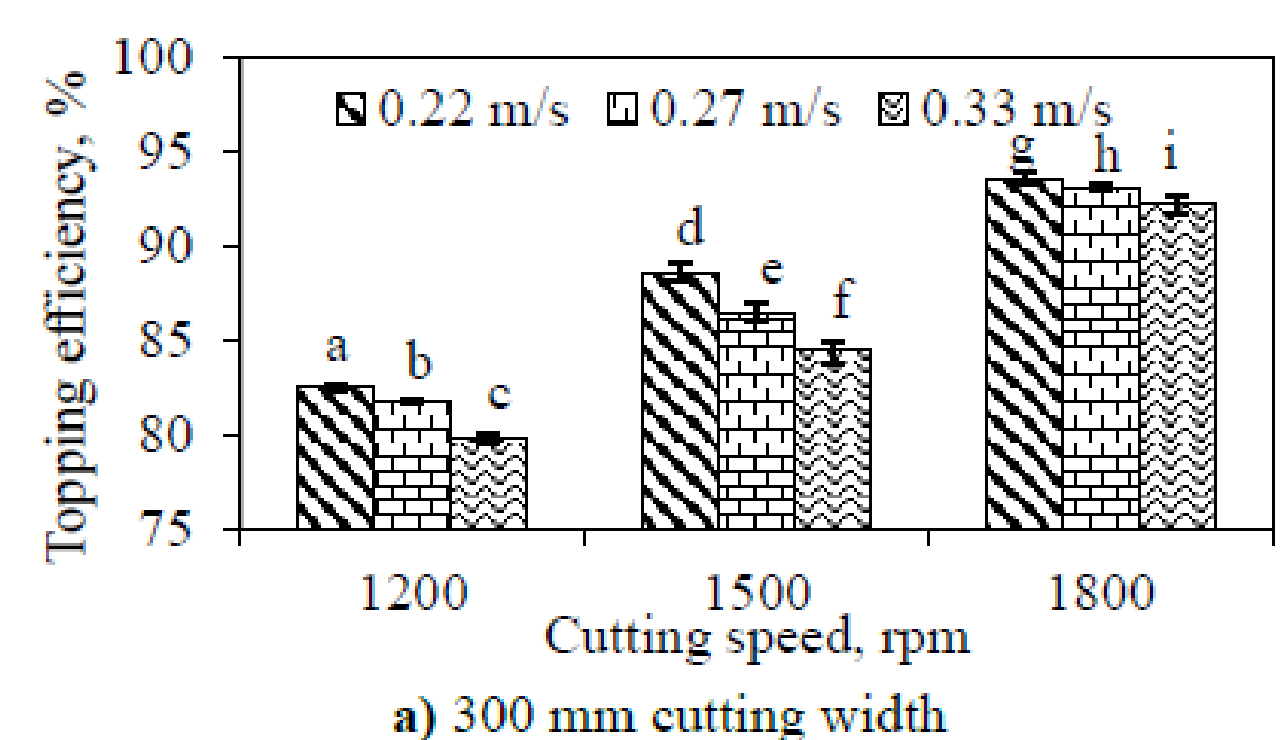


(c) Mechanical potato digger

2 Materials and Methods



3 Results and Discussion



4 Conclusions

- ✓ The cutting torque requirement decreased by **28.51%** with increase in cutting speed from 1200 rpm to 1800 rpm and it increased by **17.91%** and **7.4%** with increase in cutting width from 300 mm to 600 mm and forward speed of the machine from 0.22 m/s to 0.27 m/s, respectively.
- ✓ The mean power requirement for the topping of onion leaves was observed in the range of **257.11 W to 302.50 W**.
- ✓ It could dig out onion bulbs at a depth of 70 mm below the ground surface when operated at a forward speed of 0.83 km/h with a field capacity of **0.042 ha/h** topping efficiency of **82%**, field efficiency of **65%**, digging efficiency of **92%**, and onion bulb damage of **10%**.
- ✓ The power requirement for topping, digging with conveying and total power requirement for harvesting onion crops was measured to be **495.4 W, 311.9 W and 0.81 kW**, respectively as compared to **495.4 W, 565.1 W and 1.06 kW** when operated in the second gear of the rotor shaft due to increase in the speed of conveyor.
- ✓ Harvesting of onion crop using the developed TCD could save **73%** cost and **96%** time with respect to the traditional onion harvesting method.

5 Final Remark(s)

The project innovates specialized onion harvesting machinery for small farms, departing from manual methods, integrating wire-type cutting and conveying units for efficient automation. Rigorous testing ensures technical reliability and performance understanding, crucial for scalability and adoption. Economic analysis showcases substantial cost savings and increased hand tractor use, enhancing sustainability. Contribution to research fills crucial gaps, offering insights into onion harvesting challenges and advancing agricultural engineering. The project's social impact is notable, empowering farmers, reducing labor burdens, and aligning with broader goals of rural development.