Development of a Small Electric Work Platform with High Mobility for Apple Production in Japan

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Fruits production in Japan

Total fruits production area 200,000 ha in Japan

Apple is main fruit.
Purpose

Project

• Urgent Project for agricultural machinery development, 2008-2010

• MAFF (Ministry of Agriculture, Forestry and Fisheries in Japan)

Objectives of development

• To reduce the workload of using a ladder

• To develop a steering mechanism with high mobility

• To develop a leveling control system for the worker’s safety at a high position
Conventional work

Ladder

Deck type

Boom type

Electric platform
Developed platform

Additional platform

Elevating height of 2m

Width 600mm

Overhanging 500mm

Steering device for high mobility

Leveling control system for stability of the platform
Structure

- Leveling control device
- Hydro-electric cylinder
- Leveling sensor
- Hydro-electric cylinder for elevating
- Steering device
  - Wire, chain, sprocket
  - Simple structure
- DC motors for driving wheel
- Secondary platform
- DC motor for secondary platform

- Driving wheel
- Steering wheel
Advantages

1. Can be transported by a small pick-up truck
2. Stable platform by leveling control
3. Ability to turn in a small radius 2m, **Steering angle 60deg**
4. Continuous working duration exceeds **10 hours**
5. Can be used as carrier, with a load capacity is **200 kg** at the lowest platform position
Advantages

1. Good working posture, easy to reach apples
2. Reduce maneuvering time

Safety

1. Leveling control: Roll over angle 23 deg at highest platform, loaded maximum 100kg
2. Speed limited control: At a platform height of 1.5 m or higher, limited speed of 1km/h

Criteria for safety: Roll over angle 15 deg, Limited speed (1km/h at higher 2m)
Growers can reduce workload.

Average of 30min’s continuous work, age 40s, male worker
Leaf picking for long time

Less fatigue, growers can continue working for a longer time

Continuous work of more than 2 h, 40s male worker,

Less fatigue, growers can continue working for a longer time.
Efficiency

Leaf picking using the new platform

Dwarf tree
38% higher efficiency than commercial platform
Same as ladder

Normal tree
46% higher efficiency than ladder
33% higher efficiency than commercial platform
Efficiency

Harvesting by the new platform

For Dwarf tree and normal tree

Comparable efficiency as for ladder
Conclusions

- Developed small electric work platform. Growers work safely, with reduced workload.
- Can be used for 4 m height fruit tree.
- Commercialized on Dec. 2011. 7 platforms are marketed.
- Only one model as platform with safety certification
Harvesting
Recovery in Fukushima