

# Development of Paddy Seedling Sowing Machine to Improve Posture of Farmers

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**Keywords:** Agriculture; Paddy Seedling; Paddy Sowing

**ABSTRACT** – During paddy cultivation, the sprouted seedlings are required to be transplanted to another planting bed at a controlled distance to ensure healthy growth of the paddy plant. For the majority of local farmers, the operation must be executed manually while flexing in an awkward posture. This paper discusses the development of the Paddy Seedling Sowing Machine which was considered for its ability to collect sprouted seedlings, replanting in a new planting bed, filter muddy substances, and mobile in a muddy bed. The development of this machine may improve the productivity of local farmers while improving their working posture.

## 1. INTRODUCTION

Paddy cultivation is a very significant agricultural activity in Malaysia as it produces rice which is the staple food among Malaysians. The cultivation process begins by spreading the seeds in the nursery. When the seeds begin to sprout, it needs to be transplanted to another field to ensure that the sprouts are replanted at a proper distance from one another to ensure ample space for its growth and good quality harvest.

Although many agricultural types of machinery for the paddy cultivation process are already available in the market, nonetheless, the purchasing and maintenance cost is too high and could not be supported by local farmers who produce the paddy on a small and medium scale, which was reported as the majority group of paddy producers in Malaysia [2]. Due to economical constraints, this category of farmers would opt for the manual operation during paddy cultivation which is a highly physically demanding process.

During the collection of the sprouted seed in the infant planting bed, farmers would squat for a prolonged period. The next process which is replanting the sprouted seed in a new planting bed requires the farmers to bend in a very awkward posture. Over time, the extremely flexed posture would result in discomfort among paddy farmers. Scientific researchers had proven that paddy farmers would experience discomfort, especially in their lower back, knee, leg, pelvic joint, wrist, and shoulder [1,3]. The research also showed that paddy farmers are exposed to extremely hot weather exceeding 36°C which highly influenced their physiological health [1]. This problem would influence the farmer's efficiency and productivity.

Hence, the development of an assistive tool is

necessary to support our local farmers while improving their working productivity. This paper aims to discuss the development of a paddy seedling sowing machine to assist local farmers during the collection and transplanting of the sprouted paddy seeds. The assistive device may have the potential to be commercialized as the preliminary result showed that it improves the current operating procedure during paddy cultivation.

## 2. METHODOLOGY

The development of the assistive machine was based on four specific design criteria including (1) able to collect sprouted paddy seedlings, (2) able to replant paddy seedlings at a controlled distance, (3) able to filter out the muddy substance from the plucked seedlings, and (4) able to be operated in a muddy field. The ergonomic operating height was also considered during the development stage.

The component breakdown of the selected design concept is illustrated in Figure 1. The list of components, specific function, and material are summarized in Table 1. The primary manufacturing process involved during the construction of the primary mainframe was CO<sub>2</sub> laser cutting (Figure 2a) and Metal-Inert Gas (MIG) welding (Figure 2b).

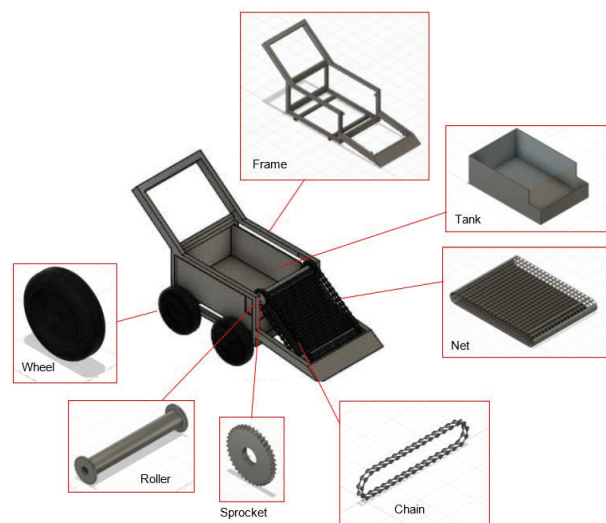


Figure 1 Component Breakdown Design Concept

The following assembly procedure was simplified to ensure convenience during maintenance activity.

a) The tank was assembled to the main frame.

- b) The first roller and sprocket pair were assembled to the upper part of the conveyor system which was attached to the motor.
- c) The second pair of the roller and sprocket pair was inserted into the conveyer net before being assembled to the lower part of the conveyor system.
- d) The chain was attached to the sprocket.
- e) Tires were installed to the four corners of the primary frame using nuts and bolts.

Table 1 List of component, function, and material

No.	Component	Function	Material	Qty.
1.	Frame	Primary mainframe of the assistive device.	Mild steel	1
2.	Tank	Storage of sprouted paddy seedlings	Galvanian sheet	1
3.	Chain	Transplanting mechanism for paddy seedling collection and transplanting	Steel	3
4.	Sprocket		Steel	4
5.	Motor		-	1
6.	Wire		Copper	2
7.	12V battery		-	1
8.	Wheel	Machine mobility	Rubber	4
9.	Rivet	Connecting individual component.	Steel	6
10.	Bolt and nut		Steel	8
11.	Net	Conveyer net	Plastic	1

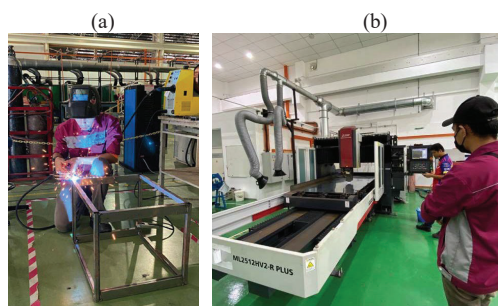


Figure 2 Manufacturing process involved

### 3. RESULTS AND DISCUSSION

Figure 3 illustrated the completed assembly of the Paddy Seedling Sowing Machine. Product testing on the actual field could not be executed as preparation of the planting bed for new paddy seedlings may take up a few months and it is highly dependent on the weather.



Figure 3 Paddy Seedling Sowing Machine

As an initiative to prove the paddy cultivation process is improved, the following illustration showcased the postural state of the paddy farmer before and after using the machine during the collection of sprouted paddy seedlings and during seedling

transplanting (Figure 4). Seedlings collections improve as the sprouted seeds are scooped into the conveyer net and transferred into the collection tank using the powered motor without requiring the farmer to squat in an uncomfortable position. Accordingly, seedlings transplanting also improves as the farmer is only required to slot the seedling into the conveyer net in a controlled distancing and transferred it into the planting bed using the powered motor. The use of the net as the conveyer platform is very convenient in filtering out muddy substances from the collecting seedlings. Furthermore, paddy producers can operate in a comfortable position without needing to flex at an awkward angle.



Figure 4 Postural state of farmer (a) before and (b) after using the machine during paddy seedling transplanting

### 4. CONCLUSION

In conclusion, the Paddy Seedling Sowing Machine was successfully fabricated. The machine can collect sprouted paddy seedlings and replant the paddy seedlings at a controlled distance. Furthermore, the use of net material can filter out the muddy substance while the attachment of the wheel enables the machine to be operated in a muddy field. It is expected that this machine may improve the productivity of local farmers while practicing a healthy postural state.

### ACKNOWLEDGEMENT

The authors acknowledge the Faculty of Manufacturing Engineering, Universiti Teknikal Malaysia Melaka for the financial support.

### REFERENCES

- [1] Banibrata Das and Somnath Gangopadhyay. 2011. An ergonomics evaluation of posture related discomfort and occupational health problems among rice farmers. *Occupational Ergonomics* 10, 1–2 (2011), 25–38.
- [2] Sarena Che Omar, Ashraf Shaharudin, and Siti Aisyah Tumin. 2019. The Status of the Paddy and Rice Industry in Malaysia. *Khazanah Research Institute*.
- [3] Amitava Pal and Prakash C Dhara. 2018. Work Related Musculoskeletal Disorders and Postural Stress of the Women Cultivators Engaged in Uprooting Job of Rice Cultivation. *Indian J Occup Environ Med* 22, 3 (2018), 163–169.