International Journal of Multidisciplinary Research and Publications
ISSN (Online): 2581-6187

Financial Performance of PHilMech Multi-Row Onion Seeder in Iloilo, Philippines

Edgar D. Flores[1], Rodelio G. Idago[2]
[1,2]Philippine Center for Postharvest Development and Mechanization (PHilMech)
CLSU Compound, Science City of Muñoz, Nueva Ecija, Philippines, 3120
Email address: edulayflores@gmail.com

***Abstract*—** *The financial performance of MROS was evaluated by analyzing its costs and benefits in planting bulb onions and comparing it with the traditional manual transplanting method. The study was conducted in Iloilo, a major onion-producing province in Western Visayas, Philippines that mainly practice manual transplanting of onion. Investment analysis was conducted to assess the perspective of a private investor operating the MROS as a service provider. Additionally, partial budget analysis was employed to assess the standpoint of onion farmers adopting the MROS over the traditional transplanting method. The adoption of MROS over the transplanting method provided significant advantages for the farmers including reduced labor cost during planting, decreased expenses for seedling production, and an increase in average yield. Investment analysis indicated the financial viability of MROS as a planting method of bulb onion, with an internal rate of return of 54.77% and a BCR of 1.61. The study suggested operating the MROS beyond the breakeven service area coverage of 25 hectares and breakeven service rate of PhP 1,518.77/ha to avoid financial loss and remain viable. Insights from this study can serve as valuable inputs for identifying specific onion-producing areas where the potential benefits of MROS can be effectively utilized.*

***Keywords*—** *Financial viability, labor shortage, multi-row onion seeder, transplanting.*

I. INTRODUCTION

Onion production is one of the important sectors in the Philippine agricultural industry, making significant contributions to the country's economy and food security. Onion (*Allium cepa L.)* has a prominent position as one of the country's major economic crops, boasting an average annual production of 218,047.33 MT harvested in 19,302.36 hectares with an average yield of 11.30 MT/ha (PSA, 2021). This crop serves as an important source of livelihood for Filipino farmers, particularly in regions where the crop is generally grown. Traditionally, manual transplanting of onions has been a common practice that becomes economically difficult due to labor shortages, especially during peak planting seasons. Addressing this issue can be achieved through the use of labor-saving technologies, particularly the use of appropriate machinery (Goreppati et al., 2017). Likewise, mechanizing onion production not only serves to optimize operational efficiency but also contributes to saving time and eases physical strain on farmers, ultimately improving overall productivity.

Considering the inefficiencies inherent in traditional onion planting methods, PHilMech developed the Multi-Row Onion Seeder (MROS). One of the main challenges associated with manual planting is the lack of labor during the peak planting season, leading to high labor costs. This problem was highlighted by the study of Briones (2017), which estimated a steady decline in the agricultural workforce since 2011. Such that, most of the farm workers leave the agriculture to find a high paying jobs in other sectors.

The developed MROS has undergone rigorous testing and field evaluation, complying with the technical parameters outlined in the Philippine Agricultural Engineering Standards (PAES 123:2001). The evaluation covered key technical aspects, including actual delivery/seeding rate, actual field capacity (AFC), theoretical field capacity (TFC), field efficiency, and fuel consumption. Interestingly, MROS successfully met all the prescribed technical parameters and criteria, indicating its effectiveness in overcoming the limitations associated with manual planting methods.

The MROS is considered technically acceptable (Flores et al., 2021; Idago et al., 2019); however, it is also important to determine its financial viability to ensure the value of its use in onion production. To address this, the MROS was pilot tested in Iloilo, a major producer of bulb onion in Western Visayas. In 2019, the Department of Agriculture (DA) declared Iloilo as the new onion-producing province in the country and has been planning to expand its production areas to 2000 hectares in succeeding years. Almost all farmers in the province practice the traditional transplanting method (Flores et al., 2020). One of the limitations identified by this planting method is the relatively higher labor requirements. During planting, the local farmers have to find laborers from nearby areas to cope with the labor shortage, leading to delays in planting operations and increased costs of planting. Although the seeder has been tested in other major onion-producing areas in Luzon (Antolin et al., 2018; Flores et al., 2018), the MROS was also tested in Iloilo considering some of the practices and conditions in the province are different that requires further assessment to adopt the seeding technology (Flores et al., 2021).

In this study, the financial performance of MROS was assessed in Iloilo where transplanting method is mainly practiced. In particular, it aimed to evaluate the viability of MROS from the perspective of a private investor who will invest in MROS and operate the seeder as a service provider and from the viewpoint of an onion farmer who will adopt the MROS over the traditional transplanting method.

Edgar D. Flores and Rodelio G. Idago, "Financial Performance of PHilMech Multi-Row Onion Seeder in Iloilo, Philippines," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 6, Issue 9, pp. 5-8, 2024.

II. METHODOLOGY

A. The framework of the study

Taking into account the technical and financial data obtained during the pilot testing of MROS, the study analyzed the financial performance of MROS and compared it with the transplanting method (Fig. 1). The study conducted a partial budget analysis to assess the viability of MROS from the point of view of farmers adopting the MROS over the transplanting method. Additionally, investment analysis was also employed to assess the financial viability of MROS from the point of view of a private investor investing and operating the mechanical seeder as a service provider.

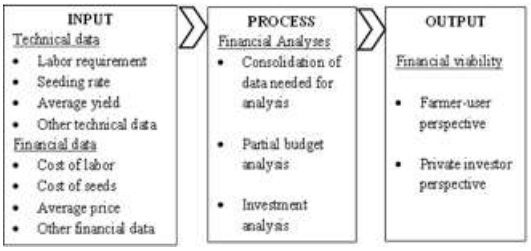

Fig. 1. Framework of the study

The study was conducted in Iloilo in collaboration with onion farmers serving as project co-operators. The selection of co-operators was based on the following criteria: being a regular onion farmer who practices the transplanting method, demonstrating a willingness to use the MROS, and having the necessary production area available for simultaneous application of both transplanting and MROS during planting. During crop seedling establishment and management, the project cooperators applied traditional production practices such as cropping calendar, onion varieties planted, land preparation techniques, rate of fertilizer and chemical applications, water management, and harvest practices.

Primary data were gathered from the field through direct measurement and observation of technical parameters including labor used, seeding rate, planting density, and average yield, among others. Moreover, financial data were gathered encompassing the average cost incurred for seeds, fertilizers, chemicals, packaging material/red bags, labor for various field operations such as land preparation, furrowing, boxing, planting, weeding, thinning, fertilizer and chemical application, harvesting, cutting and sorting as well as irrigation. Other financial data were also gathered such as expenses related to food, interest on loans, average farm-gate price and others.

B. Assumptions used in the assessment of financial performance of MROS

The data used in the assessment of the financial performance of MROS were based on the results of the pilot testing from farmer co-operators and the technical performance of the MROS (Table 1) from the study of Flores et al. (2021). As indicated, the performance of MROS was compared with the transplanting method in terms of seeding rate, number of laborers, and time of operation (Table 2). In the transplanting method, the first step involved the production of seedlings on the seedbed which requires an average of 4.47 kg of onion seeds for 1 ha then pulled up or uprooted for transplanting in the designated open field 30 to 45 days after sowing (Dela Cruz et al., 2014). This method requires a longer time of operation and a higher number of laborers for the transplanting seedlings compared to MROS. The transplanting requires 85 persons to plant the seedlings per hectare while the MROS requires 1 person to operate the machine.

In this study, it is assumed that MROS will replace the traditional transplanting method and it will have a corresponding effect on the number of labor used, seeding rate as well as average yield that will determine if it will be more beneficial to use the proposed planting technology. In addition, the analysis from the point of view of private investors assumed that the MROS would be operated as a service provider. Using MROS the cost of planting and the expenses in seedling production are reduced. On the other hand, there will be additional costs for the use of MROS in harvesting fees and the cost of packaging/red bag due to the increase in yield. The material inputs (i.e. fertilizers, chemicals) are all the same except for the seed requirement.

TABLE 1. Summary of the field performance of MROS in Iloilo

Parameters	Mean values across farms
1. Theoretical field capacity, ha/h	0.481
2. Effective field capacity, ha/h	0.351
3. Field efficiency, %	73.01
4. Fuel consumption, li/h	0.747
5. Seeding rate, kg/ha	5.84

Source: Flores et al. (2021)

TABLE 2. Comparison of MROS and transplanting method in Iloilo

Method of planting	Seeding rate (kg/ha)	Actual planting time (h/ha)	Labor requirements (person-days/ha)
MROS	5.84	2.85	1
Transplanting	4.47	7.50	85
Difference	1.37*	-4.65*	-84*

Note: *Significant at 5% level
Source: Flores et al. (2021)

C. Assessment of the financial performance of MROS

Financial benefits of using MROS were determined using partial budget analysis (farmer-user) and investment analysis for machine service providers. Partial budget analysis was used to determine and quantify the benefits and costs (Gittinger, 1982) associated in the adoption of MROS as new planting technology against the existing transplanting method. In this study, the use of MROS was compared in terms of its benefits and costs. Change in income (I) was computed using equation 1.

$$I = (Ra+Cr) – (Rr+Ca) \quad (1)$$

Where:
I = incremental income, in PhP
Ra = added revenue, in PhP
Cr = reduced cost, in PhP
Rr= reduced revenue, in PhP
Ca= added cost, in PhP

In determining the viability of investing and operating the MROS, financial indicators such as payback period (PBP),

Edgar D. Flores and Rodelio G. Idago, “Financial Performance of PHilMech Multi-Row Onion Seeder in Iloilo, Philippines,” *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 6, Issue 9, pp. 5-8, 2024.

benefit-cost ratio (BCR), net present value (NPV), and internal rate of return (IRR) were determined using equations 2 to 4.

$$PBP = \frac{Original\ capital\ investment}{Average\ annual\ groos\ margin} \quad (2)$$

$$BCR = \frac{\sum_{t=0}^{n} \frac{Bt}{(1+r)^t}}{\sum_{t=0}^{n} \frac{Ct}{(1+r)^t}} \quad (3)$$

Where: BCR = benefit cost ratio
B_t= benefits at time period t, PhP
C_t = costs at time period t, PhP
r=discount rate, %
n=project life, yrs

$$IRR = \sum_{t=0}^{n} \frac{Cft}{(1+r)^t} - C_0 \quad (4)$$

Where: IRR = internal rate of return, %
Cf_t = net cash inflow during period t, PhP
r= discount rate, %
t=number of time periods, yrs
C_0 = initial investment cost, PhP
n= project life, yrs

III. Results and Discussion

A. Financial attractiveness of MROS to farmer-users

Partial budget analysis was used to determine the effect on the cost and income of farmers adopting MROS over the traditional transplanting method. This analysis compares the changes in practices, operations and its effect on yield, cost, and income. Partial budget analysis indicated that the use of MROS provided an additional net income of PhP 74,116 (Table 3). The reduced cost of using MROS which came from the reduction of cost for seedling production, uprooting, and transplanting of seedlings was the major contributor to the additional net income of the farmer. Furthermore, the added benefits due to the increase in yield of using MROS also exceeded the additional cost incurred due to the increase in seeding rate of red creole seeds per hectare, additional labor for harvesting, and packaging materials for the additional yield. During crop establishment, the transplanted onions were slightly affected by twister disease which could result in a difference in yield. Given this observation, growing the seedlings directly using MROS was perceived to reduce plant stress from pulling-up/uprooting and re-planting of seedlings in the transplanting method thereby reducing exposure to damaging elements, pests, and diseases during crop establishment. Also, the lesser yield in the transplanting method could be attributed to the closer spacing of planted onions which results to smaller bulbs due to competition of nutrient, water, space, and light among the plants (Solangi et al., 2017; Pervez et al., 2004; Khan et al., 2016). Thus, the potential yield of MROS is higher by 1,033 kg/ha. The farm gate price during the harvest period in Iloilo was PhP 40/kg and no distinction of prices for all classifications of harvested bulb onions.

B. Financial analysis of MROS for custom servicing

The total investment cost of PhP 258, 464.04 includes the MROS, hand-tractor with trailer furrowing equipment, and operating capital. A hand tractor with a trailer will facilitate mobility and enable servicing of distant farms. The analysis describes a situation wherein the private investor borrowed the total investment from the bank. In this condition, investing in MROS is financially viable with a BCR of 1.61 and IRR of 54.55%. A BCR of 1.61 indicates that there is a net return of 0.61 for every unit of peso invested. Likewise, the IRR of 54.55% is higher than the existing hurdle rate set at 10%.

TABLE 3. Partial budget analysis of MROS and transplanting method

Incremental Benefits (IB)		Incremental Cost (IC)	
Added benefits/ha	41,333	Added cost/ha:	11,667
*Additional harvest (1033kg/ha x PhP40/kg)	41,333	Service Fee for MROS ha^{-1}	2,500
		Seeds, 15-12 cans x P1,850/can	5,550
		Harvesting Fee, 41.3 bags x P42.0	1,736
		Depreciation of using MROS	1,385
		Red bag, P12.0/bag x 41.33 bags	496
Reduced cost/ha	44,450	Reduced benefits/ha	-
Labor requirement for transplanting (85 per x PhP 300/day)	25,500		
Snacks (AM/PM) 85 per x PhP50/day	4,250		
Land preparation for seedling production	1,500		
Labor requirement for bed preparation (3 per x PhP300/day)	900		
Labor requirement for seed sowing (2 per x PhP300/day)	600		
Weeding operation-seedling production (10 persons x 300/day)	3,000		
Irrigation for seedbed (9 times x 300/day)	2,700		
	1,500		
Mulching of Seed bed (5 per x 300/day)	4,500		
Pulling of seedlings (15 per x 300/day)			
Subtotal	85,783	Subtotal	11,667
Net change in income (IB-IC=Δ in income)		PhP 74,116	

TABLE 3. Partial budget analysis of MROS and transplanting method

Particular	Private investment
Investment Cost, PhP/year	258,464.04
MROS	110,000.00
Furrower	7,500.00
Hand Tractor w/ trailer	135,000.00
Operating Capital	5,964.04
Fixed Cost, PhP/year	40,464.04
Depreciation	13,852.51
Repairs & Maintenance	4,421.67
Registration & Licenses	3,787.50
Interest on fixed investment	17,686.68
Interest on capital investment	715.68
Variable Cost, PhP/year	55,218.71
Salaries and Wages	47,250.00
Fuel, Oil, and grease cost	5,339.25
Miscellaneous cost	2,629.46
Total Operating Cost, PhP/year	95,682.76
Gross income, PhP/year	157,500.00
Net income, PhP/year	61,817.24
Measures of project worth	
Payback Period, years	1.90
Internal Rate of Return, %	54.55
Benefit - Cost Ratio	1.61
Net Present Value, PhP	361,236.67
Break-even analysis	
Breakeven service area, ha/year	24.92
Breakeven Service charge, PhP /ha	1,518.77

Edgar D. Flores and Rodelio G. Idago, "Financial Performance of PHilMech Multi-Row Onion Seeder in Iloilo, Philippines," *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, Volume 6, Issue 9, pp. 5-8, 2024.

The financial analysis also showed that the investment can be recovered in less than 2 years (1.90 years). Additionally, results also indicated a breakeven service area of around 25 hectares and a service charge of PhP 1,518.77 per hectare. These results suggest that the MROS must operate above these levels as a service provider to remain viable and avoid financial loss.

IV. Conclusion and Recommendations

The MROS underwent a pilot test in Iloilo where farmer cooperators operated the seeder based on their cultural management practices and production techniques. The financial performance of MROS was evaluated from both the perspective of a farmer-user and that of a private investor operating as a service provider. Utilizing the data obtained from the pilot testing, the financial viability was assessed through partial budget analysis and investment analysis. Farmers adopting MROS as a planting method over transplanting are expected to benefit significantly. This is because of the advantages offered by reduced labor costs during planting, decreased expenses for seedling production, and an increase in average yield. The financial analysis also revealed favorable results from the perspective of private investors. Investing in MROS is financially viable as indicated by an IRR of 54.55% and a BCR of 1.61. Based on the results, the breakeven service area coverage was approximately 25 hectares at a breakeven service rate of PhP 1,518.77/ha. The MROS must operate beyond these conditions to remain viable and avoid financial loss. The information derived from this study can serve as valuable input for identifying specific onion-producing areas where the potential benefits of this technology can be effectively utilized.

Acknowledgment

The authors would like to express their gratitude to the Philippine Center for Postharvest Development and Mechanization (PHilMech) for funding this research. Special appreciations are given to Dr. Ma. Cecilia R. Antolin, Engr. Marvin S. Estimada and Mr. Kevin Renz Pagaduan for the assistance extended in the conduct of the study.

References

[1] Antolin MCR, Dela Cruz RSM, Flores ED, Neric CF Jr, Corpuz MGA and Pagaduan KRS. 2018. Pilot testing of mechanized onion planting system using 10-row hand tractor driven mechanical seeder. Terminal report. Philippine Center for Postharvest Development and Mechanization. CLSU Cmpd. Science City of Muñoz, Nueva Ecija.

[2] Briones, M. 2017. Characterization of agricultural workers in the Philippines. Discussion Paper Series No. 2017-31. 1-30p. Philippine Institute of Philippine Studies. Available at: https://pidswebs.pids.gov.ph/cdn/publications/pidsdps1731.pdf. Accessed on July 8, 2021.

[3] Dela Cruz, R.S.M., R.G. Idago, D.R. Miranda, Q.D. Dela Cruz, J.R. Quilantang and M.P. Astejada. 2014. Technology development and commercialization for the production of year-round supply of bulb onion. Terminal report. Philippine Center for Postharvest Development and Mechanization. CLSU Cmpd. Science City of Muñoz, Nueva Ecija.

[4] Flores. E.D, Antolin MCR, Verena R.O, Idago R.G.2021. Performance evaluation of multi-row onion seeder: The case of Iloilo Province, Philippines. Asian Journal of Postharvest and Mechanization, 4(1):60-69.

[5] Flores, E.D, Pagaduan K.R.S., Estimada M.S., Antolin M.C.R, Apaga A.R.M. 2020. Adaptability of multi-row onion seeder in Iloilo Province. CLSU Compound, Science City of Muñoz, Nueva Ecija. 61pp.

[6] Flores ED, Dela Cruz RSM, Antolin MCR, Neric CF Jr and Corpuz MGA. 2018. Laboratory and Field Testing of 10-Row Onion Mechanical Seeder. Terminal report. Philippine Center for Postharvest Development and Mechanization. CLSU Cmpd., Science City of Muñoz, Nueva Ecija

[7] Gittinger, J.P. 1982. Economic Analysis of Agricultural Projects. 2nd ed. The Johns Hopkins University Press. Baltimore Maryland 21218, USA. pp. 505.

[8] Idago, R., R. Dela Cruz, E. Flores, D. Miranda and M.G. Corpuz. 2019. Performance evaluation of multi-row onion seeder. Agric Eng Int:CIGR Journal. 21 (3): 69-73.

[9] Khan A., I. U. Jan, M. Ali, M. M.l Jahangir, W. Karim, A. A. Khan, M. Ullah and M. Z. Rafiqu. 2016. Effect of different plant spacing on the performance of radish in the agro- climatic conditions of Swab. Pure and Applied Biology, 5(4): 1120-1125.

[10] Pervez, M., C.M. Ayub, B.A. Saleem, N.A. Virk and N. Mahmood. 2004. Effect of nitrogen levels and spacing on growth and yield of radish (Raphanus sativus L.). Int. J. Agric. & Biol. 6(3): 504-506.

[11] PSA 2021. Philippine Statistics Authority. OpenSTAT-Agriculture, Forestry, Fisheries Database. Available at: http://openstat.psa.gov.ph/PXWeb/pxweb/en/DB/DB__2E__CS/0062E4EVCP1.px/table/tableViewLayout1/?rxid=bdf9d8da-96f1-4100-ae09-18cb3eaeb313.Accessed: September 19, 2022.

[12] Solangi, M., A. A. Soomro, M. J. Sheikh, A. W. Baloch, S. I. Abro. 2017. Effect of sowing methods on yield and growth of spinach. Pakistan Journal of Science, 69(1):12-16.