TECHNICAL BULLETIN

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Development of Low-Cost Potato Planter and Harvester Machines

Potato plays an important role in the economy and food security of Bangladesh but the planting and harvesting operations, being carried out manually, are slow, time consuming, costly, and labor intensive which cuts down the farmers' profit margins. Moreover, severe labor shortages during the peak planting and harvesting seasons further complicate the situation for the potato farmers. Timely planting of potato, i.e., by October 15 in Bangladesh conditions, is a prerequisite for good harvests. Delayed planting may cause significant crop losses due to disease infestation and other reasons. Power tiller driven, cost effective small potato planter and harvester machines can be an effective tools to mitigate labor shortages and reduce production costs. Farm mechanization has been receiving considerable interest in recent times due to the urgent need to increase agricultural production, but unavailability of appropriate implements is one of the major constraints on the rapid development and adoption of farm machinery in the country. BARI has developed small, farmer-friendly potato planter and harvester machines (Fig. 1) but their adoption is slow due to lack of commercial availability of the machines and farmer awareness. This KGF sponsored project aimed to facilitate large scale farmer adoption of potato machinery through field demonstrations, capacity building of farmers and others involved in potato farming and increasing the number of machinery service providers.

Fig. 1. Machines developed by BARI, potato planter (top) and potato harvester (bottom)

Methodology

The project was jointly implemented by the Farm Machinery and Post-Harvest Processing and Engineering (FMPE) Division of Bangladesh Agricultural Research Institute (BARI), Gazipur

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and a private manufacturing company, Janata Engineering. FMPE, BARI was responsible for the design, modification and fabrication of potato planter and harvester prototypes and Janata Engineering for the manufacture and marketing of the machines. FMPE, BARI also field tested the machines and worked for their Dissemination through adaptive trials, farmers' training and field demonstrations. The machines were redesigned to eliminate operational problems observed in earlier field trials. The modified potato planter and harvester (Fig. 2) were evaluated in 16 farmers' fields of Bogura (Gabtali and Shibganj upazilas) and Jashore (Sadar and Jhikargacha upazilas) to popularize mechanized potato planting and harvesting among farmers.

The tools were also evaluated at the BARI Regional Agricultural Research Station (RARS), Jashore, Tuber Crop Research Sub-Station, Bogura, Breeders' Seed Production Centre (SPC), Debiganj, Panchagar and in farmers' fields of Rajshahi. Machine planted fields were compared with manual planting.

Fig. 2. Field testing of the potato planter (left) and harvester (right) machines

Results and Outputs

The belt transmission of the potato cup was changed with a chain in the potato planter. An aluminum made oval shaped potato cup was fitted with chain. The seed hopper was modified for efficient seed picking to get the potato seed easily near the cup. The field bBed shaper was redesigned to increase the bed height and soil on the potato seed. A furrow opener was incorporated to plant the seed potato deeper into the soil. Modifications in the potato harvester was done by reducing the length and speed of the conveyer belt, adding a separator in the delivery end, reducing the dimension of the cutting shovel and modifying the wheel rim for the Sifeng power tiller. Adaptive trials of the potato planters were conducted in 11.38 ha area in different locations of Bangladesh.

Effective field capacities of the potato planter and harvester were 0.11 and 0.10 ha/hr, respectively. Efficiencies of the potato planter and harvester were 76 and 74%, respectively. Yields of BARI Alu-7, BARI Alu-41 and BARI Alu-25 did not significantly vary with the planting methods, i.e., machine planting and manual planting. However, machines conferred important advantages to the potato cultivation system and potato farmers.

As for example, the planter reduced labor requirement by 89% and planting cost by 81%, and the harvester saved 56% labor requirement, 48% cost and 55% time saving compared with the manual methods. Tuber exposure for mechanical harvesting was much more than that with the manual harvesting system. Tuber damage was minimum (1%) in mechanical harvesting. A significant amount (10%) of potato remained out of unharvested in the manual harvesting system, this loss could be minimized in mechanized harvesting. The BCR and payback period

of the potato harvester were 2.1 and 1.35 years, respectively, indicating that the harvester machine could sustain potato production at an economically viable level and take care of labor shortage during the peak harvesting period.

During the Rabi 2019-20 season, 0.77, 0.88 and 4.65 ha of potato were planted at the project locations of Bogura, Jashore and Panchagar, respectively, with the planter machine. Experiments on mechanical planting and harvesting were conducted in 0.13 ha of fields at Rajshahi. Besides, self-motivated farmers at Jhikargacha, Jashore used the potato planter in 2.43 ha of land and the harvester in 4.84 ha.

The BARI potato planter and harvester were found to be effective at all project locations. In Bogura and Jashore, 60 machine operators and farmers were trained on the operation, repair and maintenance of the BARI potato planter and harvester machines through two practical training sessions. Farmers' field days, TV telecasts and newspaper reporting were done to create country-wide awareness about farm mechanization.

Expected Impact

The power tiller operated potato planter and harvester machines, with the ability of tilling the land, placing potato seeds at regular intervals and earthing up on a single run, developed by BARI, proved to be handy for potato farmers in field trials and demonstrations in various areas of northern and western Bangladesh. The potato planter can substantially reduce the labour requirement and planting costs compared with manual planting. Likewise, the harvester machine can save labor and costs by more than 50%. Use of the machine instead of manual planting and harvesting of potato has the potential to markedly increase potato farmers' profits.

Operators and farmers were greatly benefited by practical training offered by the project scientists in terms of the operation, repair and maintenance of potato planter and harvester. Manufacturing mechanics of ten workshops were trained at Janata Engineering, Sarajganj Bazar, Chuadanga. Local farm machinery manufacturers are producing and marketing potato planter and harvester. Local service providers are providing planting service to the other farmers on a custom hire basis. The Department of Agricultural Extension has undertaken a project for the distribution of 3000 BARI potato planter and harvester machines at 50-70% subsidy to the farmers for the period of July 2020 to June 2025. Overall, these potato planter and harvester machines will enhance farm mechanization substantially in Bangladesh.

Recommendations

The power tiller operated improved potato planter and potato harvester were found to be a technically suitable and economically profitable technology for planting and harvesting of potato. These machines may be recommended for dissemination among farmers through the Department of Agricultural Extension and NGOs. BARI should begin R&D work to develop tractor operated potato planter and harvester machines in the future for large scale use across the country.

This Technical Bulletin has been prepared on the basis of technical information available from a completed BKGET-KGF Funded CGP Project, the details of which are given below:

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