MECHANIZATION IN APART

ASSAM AGRIBUSINESS AND RURAL TRANSFORMATION PROJECT (APART) April 2019

Mechanization plays a very important role in Agriculture- both on the production side as well as post harvest side. This is true in any geography and any agri value chain. Though APART has a strong focus on mechanization in agri value chain, initially the major efforts are aligned on rice and potato value chains. A brief description of machine introduced in rice and potato value chains under APART is enumerated below:

A. Mechanization in Potato Value Chain:

Potato is one of the major crops of Assam that is cultivated in almost all parts of Assam, covering large areas. But, still, traditional farming techniques are used for potato cultivation. Since, potato planting and harvesting are labor-intensive, time-consuming, and also not so cost-effective, hence, under APART, the "International Potato Centre (CIP") has introduced "Potato Planter" and "Potato Harvester" in Assam for mechanized planting and harvesting through the Directorate of Horticulture & Food Processing (DoH&FP), Govt. of Assam. During the days of labor scarcity, both these machines may be recognized as an alternative option for commercial cultivation of potato, in large scale. Both these machines reduce the labor requirement, as well as cost, time, etc. Moreover, both these machines can be used to develop a service economy and entrepreneurship at the farmers' level through group efforts such as Farmer Producer Organizations (FPOs) /Farmer Producer Companies (FCCs) etc.

The following machines have been introduced on the production side of potato value chain under APART:

1. Potato Planter (Tractor Drawn): -Potato Planter can be used for planting potato tubers in the field. It ensures uniform planting distance between row to row and seed to seed. It covers a large area within a very short period of time. It reduces labor requirement and also less time consuming. It is highly cost-effective machine with a capacity of planting 1 ha area within 2.5-3 hours. It can be used for planting cut or uncut potato seed with any variety at required depth. Power requirement is 40-45 hp (Tractor). 7 Potato Planters have been procured and demonstrated in different blocks (potato clusters) of APART in the districts of *Barpeta, Darrang,Nagaon, Morigaon, Jorhat, Golaghat and Sonitipur.*

Potato Planter (Tractor Drawn)

2. Potato Harvester (Tractor Drawn): -Potato Harvester can be used for harvesting/digging of potato tubers in the field. It reduces the labor requirement as well time for harvesting. This machine is suitable for all kinds of soil, such as sandy, clay soil and loam etc.It completes the operation without damaging the potatoes. It is highly cost-effective machine with a capacity of harvesting 1 ha area within 2-3 hours. Power requirement is 45 hp and above (Tractor). 7 Potato Harvesters have been procured and demonstrated in different blocks (potato clusters) of APART in the districts of *Barpeta, Darrang,Nagaon, Morigaon, Jorhat, Golaghat and Sonitpur.*

Harvesting of Potato using Potato Harvester (tractor drawn)

B. Mechanization in Rice Value Chain

A. Production Side:

As labor and energy costs have risen across South Asia, farmers are increasingly seeking mechanized options for rice establishment that overcome labor bottlenecks while reducing other establishment costs. Alternate methods such as mechanized dry drill-seeded rice (DSR) and wet drum-seeded rice not only overcome problems of labor scarcity and reduce cost but also bring opportunities for early crop establishment. Experience elsewhere shows that, dry DSR can increase income by Rs. 7000-8000/ha without any yield penalty. Wet-DSR involves sowing of pre-germinated seeds with a radical varying in size from 1 to 3 mm on or into the puddled soil using a drum seeder. This method has economic and operational advantages over traditional planting because it eliminates the cost of raising nurseries and transportation and the occasional delay in planting due to the labor shortage. Research findings reported that a single person could sow 0.12 ha in an hour with significant cost savings compared with manual transplanting. Other major advantages of using the drum seeder include a consistent increase in yield (2–25%), reduction in maturity period (7–15 d), and a decrease in production cost. Similarly, mechanical transplanting can be used to complete the planting in a short span of time without much labor. Timely establishment of rice will also lead to timely seeding of the succeeding crop and hence enhance overall system productivity. The studies showed that mechanically transplanted rice had higher yield by 0.9 t/ha and net income by Rs. 9500/ha compared with conventional puddled and transplanted rice.

The introduction of mechanization and development of service economy/entrepreneurship are vital to improving the productivity and profitability of rice-based cropping systems in Assam. This intervention efficiently addresses the major concerns of farmers: the consistently increasing labor scarcity and production cost under traditional methods of rice cultivation. Despite the considerable yield and profitability advantages of mechanization in other parts of India, the adoption of machinery remains a challenge among small and marginal farmers due to the higher cost. Hence, creating a service economy and developing entrepreneurship may increase mechanization adoption by resource-poor farmers in Assam. Facilitating the creation of service providers and training them on drill-sown rice, mat-type nursery, mechanically transplanted rice, drum-seeder, power sprayer, power weeder, and other machines helps in their adoption at scale and makes a viable economic case for new System Intensification (SI) technologies in rice-based systems.

The day-to-day hiring of machines on a rental basis would be a better option for small farmers. The distribution of scale-appropriate machinery to potential farmers through APART will initially help create a service economy and employment opportunities in rural areas. Emphasis is on the development of a sound business model for the creation of sustainable and profitable service economy. The project is also focusing on creating a strong network among manufacturers, dealers, and service providers, which will help in providing uninterrupted services to farmers while improving/sustaining the service economy at scale.

The following machines have been introduced on the production side of rice value chain under APART:

1. Seed (cum Fertilizer) Drill: A seed drill may be used for sowing of seeds of multiple crops like wheat, pulses, soybean etc, apart from rice (sowing depth is adjustable). It requires lower seed rate and maintains optimum seeding depth as well as spacing between the rows. It further ensures uniform sowing throughout the field. Good soil and seed contact leads to improved germination. It also provides option for drilling Di- Ammonium Phosphate (DAP) as basal application. It is conducive for intercultural and plant protection measures. It's a highly cost-effective machine with a capacity of sowing a hectare in around 2.5 hours. Power requirement is 35 hp or more (tractor/power tiller).16 Seed (cum fertilizer) drills have been procured and demonstrated extensively under APART. The machines are placed one each in *KVK Darrang, Nalbari, Barpeta, Jorhat, Golaghat, Sivasagar, Lakhimpur, Sonitpur, K. Anglong, HRS Kahikuchi, Kamrup, Cachar, Dhubri, Kokrajhar, Nagaon andMorigaon.*

Seed cum fertilizer drill

2. Drum Seeder: A drum seeder economizes heavily on the labour requirement and is suitable for sowing the pre-germinated paddy seeds directly in wetland. For using the drum seeder, the land requires ploughing, puddling and levelling properly and left for 2 days for settling. It also eliminates the process of Seed bed preparation. It takes around five hours to sow one hectare. The drum seeder has a length of around 2 m, width 1.5 m and height of 0.65 m and is made of plastic/fiber and hence comfortable for women also, causing minimal drudgery. The machine is driven manually (one labor required). 100 drum seeders have been procured and demonstrated under APART and are placed at *KVK Darrang (5), KVK Nalbari(5), KVK Barpeta (5), KVK Jorhat (5), KVK Golaghat(5), KVK Sivasagar (5), KVK Lakhimpur(5), KVK Sonitpur (5), KVK K. Anglong (5), HRS Kahikuchi(5), KVK Kamrup (5), KVK Cachar(5),KVK Dhubri(5), KVK Kokrajhar(5), KVK Nagaon(5), KVK Morigaon(5), RARS Sholongoni (4), RARS Titabor (4), RARS Lakhimpur (4), RARS Diphu (4), RARS Gosaigaon (4)*

Drum Seeder

3. Paddy Transplanter: Paddy transplanter offers the advantage of timely transplanting seedlings at the optimal age (14-18 days). It ensures uniform spacing and optimum plant density (30-35 hills/m2 with 2-4 seedlings per hill), leading to higher productivity (5-6 t/ ha) compared to traditional methods. This has emerged as a promising technology to address the problem of labor scarcity. It further offers scope of creation of employment opportunities for rural youth through the development of custom service business as an alternative job and also for women in the form of nursery enterprise. The machine can transplant seedlings in an area of one ha in five hours from mat nursery. Seven paddy transplanters have been procured and demonstrated under APART. One machine each is placed at *KVK: Kamrup, Morigaon, Barpeta, Dhubri, Kokrajhar, Jorhat and Nagaon.*

Paddy transplanter

4. Power Weeder: Power weeder is used for carrying out weeding operations in between the paddy rows. It is helpful in DSR field to control weeds and offers great advantage in terms of time and labour saving. Power source is petrol (around 6 liters for one ha) and the machine can weed out one hectare in 6-7 hours. 16 Power weeders have been procured and demonstrated under APART rice value chain and are placed at *KVK: Kamrup, Morigaon, Darrang, Nalbari, Barpeta, Dhubri, Kokrajhar, Cachar, Jorhat, Nagaon, Golaghat, Sivasagar, Lakhimpur, Sonitpur, K. Anglong& HRS Kahikuchi.*

Power weeder

5. Battery operated sprayer (cum spreader): A battery operated sprayer (cum spreader) economizes heavily on the labour requirement and is suitable for spraying of weedicide as well as spread of fertilizer by using battery power (one labor required). Once the battery charged will work for 6-8 hrs which helps in uniform pressure regulation during herbicide application and herbicide application efficacy is also increased. 120 sprayer-cum-spreader have been procured and demonstrated under APART and are placed at *KVK Darrang (6), KVK Nalbari(6), KVK Barpeta (6), KVK Jorhat (6), KVK Golaghat(6), KVK Sivasagar (6), KVK Lakhimpur(6), KVK Sonitpur (6), KVK K. Anglong (6), HRS Kahikuchi(6), KVK Kamrup (6), KVK Cachar(6),KVK Dhubri(6), KVK Kokrajhar(6), KVK Nagaon(6), KVK Morigaon(6), RARS Sholongoni (5), RARS Titabor (5), RARS Lakhimpur (5), RARS Diphu (4), RARS Gosaigaon (5)*

Battery operated sprayer (cum spreader)

B. Post-harvest side*:*

Harvesting is generally done manually and farmers dry their paddy bundles on the field for a 5 to 8 days in Assam. This practice enhances the qualitative and quantitative loss of paddy and results in a delay in the establishment of the next crop. Similarly, the traditional method for storage and traditional milling machine without a rubber roller lead to a qualitative and quantitative loss. Currently, farmers store grain in sacks in their house or reed- or bamboo mat-lined grain stores. These are subject to damage caused by storage pests and diseases, which results in reduced grain quality and physical losses. Postharvest losses in cereals have been widely estimated and accepted to the extent of 15–25%, but these could be even more in different agro-ecosystems, particularly when the quality of the produce is also a problem. Post-Harvest Mechanization (PHM) can be a useful tool not only to minimize postharvest losses but also to supplement labor scarcity and off-set the increasing labor costs besides reducing drudgery. The following machines have been introduced on the post-harvest side of rice value chain under APART:

1. Axial Flow Thresher: Axial Flow Thresher (AFT) can thresh and clean the paddy in one single operation. Threshed paddy, straw and chaff are collected separately. It also helps to vacate the field earlier so that second crop can be sown/planted timely.The machine is generally operated by tractor (35 hp or more) has a capacity of threshing 1.6 t grains per hour. Nine AFTs have been procured and demonstrated under APART. The machines are placed one each with *KVK- Cachar, Darrang, Dhubri, Golaghat, Kamrup, Jorhat, Morigaon, Nagaon and Nalbari.*

Axial flow thresher

2. Portable Rice Mill: In Assam huller machines with steel roller are used for rice milling which causes high broken percentages. Portable Rice Mill (PRM) with rubber rollers is being used to reduce broken percentage. The machine facilitates one pass operation for milling and polishing. Broken percentages are reduced to 2-5%. Another major advantage offered by the machine is that farmers need not transport their crop, rather machine reaches the farmers' place. The machine is trolley mounted. The capacity of the machine is one tonne per hour and power requirement is 42 hp or more. Six PRMs have been procured and demonstrated under APART rice value chain program and are now placed one each at *KVK- Barpeta, Jorhat, Kamrup, Karbi-Anglong, Golaghat and Nagaon.*

Portable rice mill

3. Paddy Reaper: One of the greatest advantages that paddy reaper offers is that the crop is reaped from bottom and the straw after threshing can be used as animal dry fodder. It further reduces the grain loss by harvesting the crop in right time. The machine offers another advantage in terms of time &labour saving. The machine takes around four hours to reap a hectare of crop and the power requirement is 5 hp. Nine reapers have been procured and demonstrated in APART and are now placed one each in KVK- Cachar, Darrang, Dhubri, Golaghat, Kamrup, Jorhat, Morigaon, Nagaon and Nalbari

Paddy reaper

4. Solar Bubble Dryer: Solar Bubble Dryer (SBD) has an inflated solar tunnel, 2 solar powered blowers and is used to dry paddy to optimum and uniform moisture levels at field level. The dryer comes in two capacities i.e. 0.5 t and 1 t. For one tonne capacity the dimensions are 25m length and 2m width. The greatest advantage of this dryer is that it uses solar power and involves no operating cost except for 2 labors. However, the grains can be dried in cloudy condition also. During sunny days drying time is similar to sun drying while during cloudy days, it takes around 2 days to dry to optimum moisture levels. In addition, it also offers protection from rain and animals. The top cover is made of UV-LDPE while the bottom is made of reinforced PVC. Two SBDs have been procured and demonstrated under rice value chain of APART and are now placed at *KVK Kamrup and KVK Jorhat.*

Solar bubble dryer

5.Grain Bag/Super Bag: Grain bag is used to store seeds and grains hermetically and protects the contents from insect/fungus attack. Germination rate and seed viability are maintained. Life of super/grain bag is 2-3 years and any non-perishable commodity can be stored. The capacity of the bag is 60 Kg. The bag is made up of polyethylene of 60-micron thickness with gas barrier coating. 8000 super/ grain bags have been procured and demonstrated in the rice value chain under APART through KVKs/RARSs/HRS.

Grain Bag/Super Bag

6.Dry Grinding Machine (DGM): DGM finds application in preparing rice floor. Using DGM, broken grains that are separated in indent cylinder separator can be milled to rice floor which can be used for making pithas. The machine requires 15-20 hp motor and electricity connection of 1/3 phase. Capacity of the machine is 10-12 Kg/hr. The machine comes with standard accessories like filter, stainless steel vessel to collect ground materials, different sizes holed screen for getting different mesh powders. Four DGMs have been procured and demonstrated under APART and are now placed, one each at *KVK Darrang, Lakhimpur, Kamrup and Jorhat.*

Dry Grinding Machine (DGM)

Published by :

ARIAS Society
(An Autonomous Body of Govt. of Assam)
Agriculture complex, Khanapara, G.S. Road,
Guwahati-781022 (Assam, India)
Tel: +91 361-2332125; Fax: +91 361-2332564;
email: spd@arias.in, Website:www.arias.in
Grievance Rederessal officer: grievances@arias.in