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Review Article

Status of Rice Mechanization in India: A Review

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ABSTRACT

Mechanization is the key to achieve sustainable rice production in India. Presently in rice cultivation land preparation and harvesting operation is highly mechanized but intermediate farm operations are performed manually. Growing rice in conventional and traditional practices required higher and uneven distribution of inputs that results in adverse impact on environment and also reduces the rice productivity, and profitability. To achieve sustainable and environment-friendly rice farming, new technologies need to be adopted to reduce its environmental footprint. This paper provides knowledge about present practices of rice cultivation including machinery, energetics, and identify future research thrust to enhance the mechanization level of rice in India.

Keywords: *Machinery, Mechanization, Rice.*

INTRODUCTION

Rice is the staple food for about four billion people i.e., half of the humankind on the planet, and in present scenario rice is the world's most important food crop. In Indian context rice is the staple food for more than 65% of population, thereby, is most important to food and livelihood security of people. Presently, in world rice production is touched upto 500 MT milled rice that feeds 4 billion people and in India the production touches 112 MT milled rice used to feed 0.8 billion peoples that is 65% of the population (Pathak, 2020; & Guru et al., 2018). The rapid growth of population in India also generate more demand of rice production in near future. In future prediction of India for the year 2030-31 total population of 1.51 billion generate demand of 137.29 MT and this demand continues grow at rate of 2.15 % in a year (Pathak, 2020). Rapid increase in population leading an immense pressure on Indian agriculture to produce more food in order to get food and nutritional security. On the contrary, the average land holding size is in a decreasing trend in India and as per estimate presently land holding size is 0.68 ha, and will be further reduced to low of 0.32 ha in year 2030. With all these challenges, India is a developing nation and facing a challenge of ensuring food security for the most populous country by 2050 (Patel et al., 2018).

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To achieve the food security farming practices should be multi-functional and highly mechanized to become ecologically sustainable. The main challenges needs immediate attention are food, water and energy insecurity; issues related to climate change; and degradation of natural resources. Farm mechanization can play a key role in addressing these challenges for large as well as small-holder farmers.

Recent development in farm machinery not only ensure timeliness in operation but also added benefits of higher land productivity, low crop losses, good quality of agro-produce, enhanced input use efficiency, with reduced cost of cultivation. There is a close nexus between farm power availability and agricultural productivity. Farm mechanization having contribution in saving precious inputs seeds (15-20%), fertilizers (15-20%), time (20-30%), and labour (20-30%). Cropping intensity (5-20%), and productivity (10-15%) also enhanced by higher level of farm mechanization (Guru et al., 2019).

Farm mechanization is low in the rice-based farming systems in India. However, it is picking up and many of the small and big farm-machineries are now a common sight all over India. Tractorization in agriculture helps in on-time farm operations with low labour and cost, precise inputs, minimize energy losses and helped in large area coverage. In rice based cropping system managing rice straw is a big challenge. Complete machinery package need to introduce to enhance the production and also it helps in minimize the input energy and cost involves in rice based cropping system. The use of machinery for field preparation operation for rice cultivation is high and most of the farmers of India are using tractor with matching implements for deep ploughing and puddling operation. But the further operation viz. sowing, transplanting, harvesting and threshing is done manually and having very low level of mechanization. There is need to consider collect all the information related to rice mechanization in India, and identify challenges in mechanization and also suggest future research thrust to enhance the mechanization level of rice in India.

Present status of rice machinery in India

Tillage

On animal powered farms primary tillage is done by using Desi hal (Country plough), and MB plough. animal drawn plough is still used for tillage in Himachal Pradesh, Assam, Bihar, UP, Odisha, West Bengal and Andhra Pradesh. Mostly these plough manufactured by local craftsman and design is differ from place to place. Animal drawn disc harrow, Spike harrow, Spring type harrow, Blade harrow, Zig-zag harrow, Three and five tyne cultivators, Clod crusher, Chisel ploughs, Sub-soilers, Scraper, Bund former and Wooden leveler are commercially available.

On tractor powered farms MB plough and cultivators are two most commonly used implements. MB plough is used for primary tillage operation and cultivator is used for primary as well as secondary tillage operations. Tractor drawn disc harrows are popular for dry secondary tillage operation. Now rotavator is gaining popularity due to its capability multiple operation in one time. The rotavator is powered by the tractor PTO. Saving of 60-70 percent in operational time and 55-65 per cent in fuel consumption with single rotavator compared to the conventional method of seed bed preparation with separate ploughing and harrowing operations have been observed, besides conservation of moisture due to destruction of capillaries.

Puddling

Puddling operation is performed to reduce deep percolation of water, to kill weeds by decomposing them and to facilitate transplanting of paddy seedlings by making the soil softer. In animal powered farms for puddling operation bullock drawn Cono-puddlers, Disc harrow-cum puddler, in power tillaer or tractor powered farms power tiller mounted Cono-puddler, Power tiller rotavator and tractor drawn paddy disc harrow, cage wheel with cultivator and rotavator, are machinery used for puddling. These puddlers are available commercially.

Land leveling

On animal powered farms land leveling is done by scoop, buck scraper, Singh patella, and in power tiller or tractor powered farms leveling is performed by using wooden planker, leveller before sowing of seeds under dry soil.

Seeding, Planting and Transplanting

Rice is grown either by direct seeding i.e. broadcasting, drilling in dry soil, sowing in wet soil or by transplanting. There are plenty of sowing implements developed for manual, animal, power tiller, and tractor. Most of them are for dry direct sowing of rice. Dry paddy seeds are sown with one, two and three row manual seed drill, three row animal drawn seed drill, self-propelled hill seeder, power tiller and tractor drawn seed drill for upland conditions for plain terrain whereas manual, bullock drawn and power tiller drawn seed drills are suitable for hilly terrain. For wet direct sowing of rice manual operated drum seeders are popular. The manual drum of 4-rows and 6-rows seeder being light in weight can be operated easily by female farm women in low land area. Manual drum seeders of 4, 6 and 8-rows are available commercially. For tranaplanting of rice manual operated transplanter and power operated transplanters are commercially available.

In SRI method, young (8-10 days old) seedlings are transplanted by manually. The row to row distance and within a row plant to plant distance should be 250 x 250mm. With this spacing, there will be 16 plant per square metre in SRI method.

Weeding

Manual weeding and chemical weeding are two most common methods used by rice farmers of India. Number of weeders designed for upland as well as lowland rice crop are commercially available. Adoption of mechanical weeding is still low. The principal demerit of chemical weeding is the loss of soil fertility and useful soil microorganisms are affected in the long run.

Fertilizer application

Mostly manual broadcasting of fertilizer is performed by farmers. In dry direct sowing of rice fertilizers are applied as basal dose at the time of sowing.

Plant protection

Different types of duster and sprayers have been developed for operation by hand, a small engine, power tiller and also by using the tractor power. For application of pesticides, the farmers most commonly use hand compression sprayer, knapsack sprayers and power sprayers. Different designs of low cost hand-operated sprayers, power sprayers and tractor mount sprayer and duster are commercially available for application of plant protection chemicals. Low volume and ultra low volume (ULV) sprayers, which require comparatively smaller quantity of water, are also in use.

Harvesting

For rice harvesting many technologies have been developed i.e. reaper, combine harvester etc. but in eastern India still manual harvesting using sickle is predominant method of paddy harvesting. It takes about 170-200 man hours to harvest one hectare of paddy crop. Improved sickles, walk behind self-propelled vertical conveyor reaper harvester, power tiller operated vertical conveyor windrower, animal drawn reaper, tractor rear mounted reaper windrower, tractor operated straw combine, Reaper binder and combine harvester are available commercially. These harvesting equipments are being used by famers for harvesting of paddy for plain field on custom hiring basis.

Threshing

Manual threshing of paddy under feet, beating shelves of rice, beating crop with a flail, treading a layer of 15 to 20 cm thick harvested crop by a team of animals are traditional methods followed by farmers depending upon capacity, lot size and situation. On animal powered farms threshing by bullock treading is practiced on large scale in the country but it is also time consuming and involves drudgery. Pedal operated thresher is used for threshing of rice by the farmers of West Bengal, Odisha, Assam, Andaman, Bihar and Jharkhand states. The output capacity, threshing efficiency and labour requirement were 44 kg/h, 98.8% and 5.0 man-h/q, respectively. Power operated

axial flow thresher works on axial flow principle. It consists of spike tooth cylinder, straw thrower, concave, sieve shaker and aspirator blowers. It is suitable for threshing rice. It can be operated with power tiller, tractor, engine and electric motor. Pedal operated, animal drawn, power tiller operated, tractor drawn and electric motor operated threshers are commercially available and have become very popular for threshing operation in plain region. Axial flow thresher operated by single 1.5 kW motor/power tiller engine was developed for hilly region. The capacities of power tiller and tractor operated axial flow threshers are 3 to 5 q/h and 10 to 12 q/h, respectively.

CONCLUSIONS

The use of machinery for field preparation operation for rice cultivation is high and most of the farmers of India are using tractor with matching implements for deep ploughing and puddling operation. But the further operation viz. sowing, transplanting, harvesting and threshing is done manually and having very low level of mechanization. There is shortage of farm labours and declining interest of youths in agriculture. With increase in wage rate of farm workers along with cost of other inputs, rice farming is gradually becoming less remunerative. Mechanization of traditional rice farming practices can overcome the crisis and help in drudgery reduction.

Compliance with Ethical Standards

Conflict of interest

The authors declare that they have no conflict of interest.

REFERENCES

Guru, P. K., Borkar, N., Debnath, M., Chatterjee, D., Sivashankari, M., Saha, S., & Panda, B. B. (2019). Rice mechanization in India: Key to enhance productivity and profitability, Rice research for enhancing productivity, profitability and climate resilience, ICAR-National Rice Research institute, Cuttack, India, 337-351.

Guru, P. K., Chhuneja, N. K., Dixit, A., Tiwari, P., & Kumar, A. (2018). Mechanical transplanting of rice in India: status, technological gaps and future thrust - ORYZA-An *International Journal on Rice*, *55*(*01*), 100-106.

Patel, S. P., Guru, P. K., Borkar, N. T., Debnath, M., Lal, B., Gautam, P., Kumar, A., Bhaduri, D., Shahid, M., Tripathi, R., Nayak, A. K., & Pathak, H. (2018). Energy footprints of rice production. NRRI Research Bulletin No.14, ICARNational Rice Research Institute, Cuttack, Odisha, 753006, India pp. 1-26.

Pathak, H. (2020). Agricultural Research and Development: Policy and Program Priorities in India. Agricultural Policy and Program Framework: Priority Areas for Research & Development in South Asia, *chapter -5*, 93-115.

Pathak, H., Tripathi, R., Jambhulkar, N. N., Bisen, J. P., & Panda, B. B. (2020). Eco-regional Rice Farming for Enhancing Productivity, Profitability and Sustainability. NRRI Research Bulletin No. 22, ICAR-National Rice Research Institute, Cuttack 753006, Odisha, India. 28.