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Mechanization for Precision Rice Farming Systems: A Success Story from Andhra Pradesh, India by Praanadhaara

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Introduction

India is predominantly a Rice producing country. Yet, unlike countries like Japan or Korea, Rice production in India is labour intensive and drudgery-based crop, which requires around 850-900 man hours for cultivating 1 hectare of Rice. Just 3 operations of this crop production require about 90% of the total labour input, viz., Transplanting (38%), Weeding (19%), Harvesting and Threshing (32%). Large scale migration of villagers to urban centres, especially the working class, has resulted in severe shortages in farm labour availability. This has in-turn led to unviable labour pricing, typically during the peak operations period. The situation has thrown the farmer into a complex paradox of the compulsion to grow rice, due to the canal irrigation system, while returns from rice production have only been depleting the farmers' capital resources. Cost of labour for these three operations have reached an astronomical 65% of the crop cultivation costs, from what was 15 to 20%. Yet, due to lack of administrative and institutional support, technological interventions and mechanisation in rice cultivation, suitable for the Indian scenario, continued to be at a very low levels.

Present Status of Mechanisation in Paddy Cultivation

Tractors, used mostly for land preparation, constitute about 60% of the total machinery used in the Rice farming systems in India. Extrapolating this figure with a total of about 5% of the labour requirement for this operation, mechanization for this operation accounts only for 3% of the total labour replacement. Similarly, with about 5% mechanization in transplanting and 23% in harvesting & Threshing, machines have so far replaced only about 2% and 8% of labour from these two operations.

The paradox therefore continues. Whether to cultivate and perish or perish without cultivating their land is the dilemma facing the Indian farmer. Lack of pricing support either for inputs or output adds to the complexity.

Development of new machines and technological innovation are therefore imminent, in order to save the farmers and the crop, since readymade solutions are not yet available to the small and marginal farmer.

The Major Impediments to Increasing Mechanization

The adverse pricing and adaptability of mechanized transplantation, non-availability of inter-cultivation equipment in deep-puddle-wet-crop conditions and the inflexibility of the large sized combine harvesters to fit into to small farm units, are the main impediments for large-scale adoption of mechanization of the Rice farming systems in India.

The Success Story - A Case Study from Andhra Pradesh India

Extensive research was conducted by Praanadhaara Foundation during the last 7-8 years, on the three specific areas of reducing usage of human labour, while increasing mechanization, with the sole intent of reducing the cost of human labour input to less than 10%.

Researching with the farmers at Jammulapalem Village, Bapatla Mandal, Bapatla District, Andhra Pradesh, India, Praanadhaara successfully demonstrated that direct sowing of rice (DSR) seed, instead of transplanting pre-grown seedlings, not only reduced the cost of labour by about 20% of the transplanting costs alone, it actually produced better yields, contradicting the belief that transplanting seedlings would increase tillering and yields.

DSR to Replace Transplanting Operations

In over 6000 acres, at the behest of Praanadhaara, farmers of Jammulapalem village had adopted the standardized

mechanized D-DSR practices, during the 20-to-30-day window, between the 1st monsoon showers and release of canal irrigation water.

Initially, D-DSR was adopted by using bullock drawn seed drills and later adopted and standardised tractor drawn seed drills.

Simultaneously, modified primary tillage techniques were adopted, which required east-west directional ploughing followed by north-south directional ploughing and spreading of basal doses of fertilizer and soil borne insecticides, through mechanical spreaders.

Compaction and smoothening of the soil along with seeding operation, with tractor drawn blade/bar compactors, mechanised application of pre-emergent herbicides.

These 4 operations were conducted by tractors specifically designed to undertake single specific operations independently, as 1 set of mechanization drive, covering about 8-10 hectare in 10 working hours. A total of 160 tractors (40 sets) were used to complete rice seeding in about 400 hectares per day and completing the 2400 hectares of D-DSR operations in just 6 -10 days.

It was realised that, through such collective operations of D-DSR, farmers had saved about Rs.12,500/- of crop production cost, per hectare.

1.Cultivatow with Blade Harrow

2.Rice Hill Drop Drilling Machine

3.Soil Compactor (Adda)

4. Pre-Emergence Herbicide Application

5. Furrow Opener in AWD Practises

6. Crop after 20 days

W-DSR (Wet Direct Seeding of Rice)

Realizing the fact that, it would not be always possible to undertake D-DSR throughout the Rice growing belt of Andhra Pradesh, covering over 6 districts, with varying rainfall periods and release of canal irrigation water, Praanadhaara experimented with direct sowing of rice (DSR) seed under wet conditions too. This was achieved by suitably modifying the seed drill equipment to suit the wet post-puddled conditions and undertake the direct sowing of seeds.

Under W-DSR, primary tillage was undertaken with Puddling the field with rotovator and levelling the puddled soil with wooden compactor. A technique for providing intermittent drain channel furrows with tractor drawn Double Furrow Opener was used, for providing improved drainage system.

In the absence of readily available machinery or technology, extensive and challenging research was done to undertake appropriate modifications to the tractors and their drive mechanisms, to suite the wet and sinking conditions, while retaining their power and traction abilities.

1.Puddling

2.Wooden ladder for levelling

3.Double Furrow opener

4.wet Seeding

5. Herbicide Spraying

6. Crop after 20 days

Inter-cultivation operations in Rice Crop:

Apart from undertaking the W-DSR operations efficiently, technological modifications to the tractors helped achieve the much-needed reduction in labour use and drudgery, in the weeding operations too.

By designing a whole set of tractor drawn inter-cultivation equipment such as aerator cum weeder / roto weeder, fertiliser and pesticide applicators, Praanadhaara had helped the farmers of Jammulapalem achieve huge reduction in the cost human labour for undertaking the weeding, fertiliser & pesticide applications also.

Compact Tractor

Modified Compact Tractor

Weeding in wet condition by Roto Weeder

Weeding in wet condition by Aerator cum Weeder

Weeding in dry condition using blade harrow

Fertiliser Spreader

Boom Sprayer

Double Furrow opener for AWD practices

Single Furrow opener for AWD Practices

Benefits

Farmers of Praanadhaara have not only realised increased yields due to DSR, but also had saved huge amounts of crop production costs, thereby increasing their net revenues from cultivating Rice.

Conclusion

Praanadhaara has proved that “Easy Rice Farming” by using modified mechanization is possible in India, with sustainable results.