



Impact Analysis of the Mechanization Program for Tribal Paddy Farmers of Goa

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INTRODUCTION

The small but beautiful state of Goa has cropping land under three types of topography viz. *khazan*, *kher* and *Morod*. The cropping systems practiced are different under different topography. Agriculture in Goa is severely hampered due to non-availability of labour for timely operations on the farm, resulting in huge amount of post-harvest losses (Gupta *et al.*, 2019). Intervention in the form of mechanization could make agriculture a sustainable and profitable profession. Agriculture activity in the State had a declining trend of work participation *i.e.* the percentage of workers in the agriculture sector had declined from 60% in 1960 to 27.5% in 1991 and to 16.6% in 2001 population census (Annonymus, 2014). With the ban on mining in the state since September 2012, there has been a renewed revival in agricultural activities in many talukas of the Western Ghats area of Goa.

Mechanization in Goa faces severe constraints in the form of fragmented land holdings, inaccessible, undulating and sloping terrain. Directorate of Agriculture Goa has initiated 75% subsidies on power tillers and other machinery to farmers. In the year 2011, ICAR-CCARI (formerly ICAR Research Complex for Goa) initiated a program on Mechanization of small and tribal farmers of Goa funded through Tribal Sub Plan from 2011.

The program targeted the tribal paddy farmers of Goa and distributed machinery for mechanization of paddy cultivation to them from the year 2011 to 2015 with the objectives: (1) to choose suitable locations in Goa and select/set-up farmer groups and distribute to each of them a set of agricultural equipment and implements, (2) train the groups of the community in use of these implements and equipment and (3) Impact analysis of the project. Various methodologies for impact assessment have been analyzed and used by researchers (Doss, 2006, Janvry *et al.* 2010, Nakano and Kajissa, 2012, Kebebe, 2017, Ogundari and Bolarinwa, 2018) for agricultural technologies. In this study the authors adopted exhaustive feedback, collected in the form of questionnaires and interviews from all the beneficiaries, Analyzed with respect to their social, agronomic and financial impact.

MATERIALS AND METHODS

Selection of farmers and moving on

Under this scheme in the first year (2011) 8 tribal farmers groups were selected and a basic set of equipment viz. power tiller with accessories, mini rotary tiller, power reaper and brush cutter were distributed and after first season and three years of use the impact of these machineries on the social, agronomical and financial status of the beneficiaries was assessed.

Data collection

Group discussions, on-the-spot inspection and interviews using predesigned questionnaires were used as methods for feedback data collection from farmer beneficiaries directly after the cropping season of the first and third year. Prior information about the visit and location was given to the groups to ensure maximum beneficiaries presence. All the available beneficiaries on the day of visit were assessed. Data was collected based on (1) Physical observation: the machinery, financial books and meetings proceedings and society certificate were inspected in detail, (2) Interviews were conducted on all the respondents and (3)

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ABSTRACT

This paper assessed the impact of the mechanization of the 8 tribal paddy farmers' groups of Goa benefited in the year 2011 through the Tribal sub-plan program of ICAR-CCARI through results of surveys conducted in 2012 and 2015. Shift to mechanization among beneficiaries was significant in power tillers (64-100%) but less in power reapers (0-91%). Also significant saving in manpower (Power tillers: 33.3% to 60%, power reapers: 33.3% to 83.3%), time (field capacity increased (power tillers : 41.7% to 141%), power reapers: 58.1% to 912.8%) and cost (power tillers: 44.7%, to 59.1%) power reapers: 57.8% to 82.9%) was reported through the use of equipment as compared to desi plough or manual methods of harvesting. Some constraints like lack of access roads and training in use and maintenance of the equipment were reported by the beneficiary farmers.

KEYWORD

Farm mechanization, Power tillers, Power reapers, Mini Rotary Tillers

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Group discussions on constraints and also impromptu demonstration of some equipment to convince the farmers to use them were done.

The assessment was aimed to analyze whether the equipment were properly utilized by the beneficiaries, what were the benefits achieved, and any other issues.

The assessment was concentrated on various aspects *viz.*, (i) **Social Impact:** (a) Basic information about the group: when group was formed, how many members, (b) Are general/executive committee meetings held regularly? and (c) Does ownership of machinery affect integrity of group?; (ii) **Agronomical Impact:** (a) Benefits in cropping in terms of area, (b) timeliness, (c) No. of farmers and (d) types of farming operation *viz.* tilling, puddling etc.; (iii) **Financial Impact**

RESULTS AND DISCUSSIONS

The data was collected from all the tribal farmer beneficiaries based on physical observation, interviews and group discussions and analyzed. The results are presented below:

Characteristics of the beneficiaries and their farming pattern

The groups comprised mostly of primary school educated (44), secondary school educated (34 farmers) and illiterate (16 farmers). The land holding pattern (Sud, 2012) (Fig. 1) indicated that out of the 90 beneficiaries assessed 46% were small farmers, 20% were marginal farmers and 21% were semi-medium farmers, only 2% were medium farmers and 1% were large farmers. The main constraints faced in use of the equipment were due to fragmented land holdings and lack of access roads.

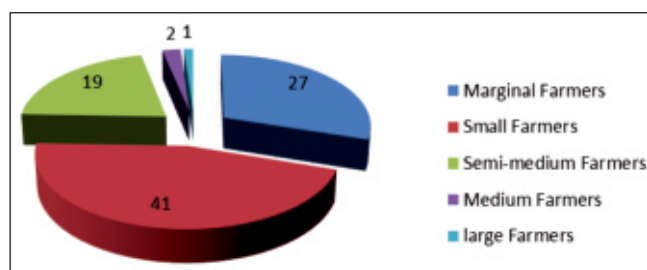


Fig. 1: Land Holding Pattern of beneficiary farmers

Table 1: Total area under various crops

Name of Crop	Total area under the crop
Paddy	56.6 Ha
Coconut	2.92 Ha
Cashew	3.64 Ha
Areca nut	0.14 Ha
Banana	0.074 Ha
Mango	20 Sq.m.
Pineapple	50 Sq.m.
Jasmine	1 Ha

Cropping Pattern of the beneficiaries:

It was observed that the general cropping pattern was Paddy during Kharif followed by Vegetables and perennial plantation crops grown were Coconut, Cashew, Arecanut, Banana, Mango, Pineapple etc. The total area under these crops in the selected beneficiary groups is given in Table 1. The topography of the area was undulating slopy and in some places like Karvem and Morpirla, the cultivation was done in benches.

The impact assessment on labor and power saved was done for two equipment *i.e.* power tiller and power reaper. For the other minor equipment like brush cutters and mini rotary tillers, it was only asked if they had used the equipment. The data collected and analyzed is summarized in Table 2a, Table 2b and Table 3.

Social Impact

The project under the Tribal Sub Plan had a positive impact on

Table 2b: Impact Assessment of Power tillers on the beneficiary groups (after three years)

Group name	Average Productivity of paddy (kg/ Sq. m)	Average area under vegetables (Sq. m)
Samrat SHG	0.35	1550
Karmgal SHG	0.46	373.33
Sai Nath SHG,	0.19	920
Nakeripurush	1.41	-
Mahila SHG		
Shivnath SHG	0.25	200
Devi SHG	1.025	1920

Table 2a: Impact Assessment of Power tillers on the beneficiary groups (after one crop season)

Self Help Group	Avg. paddy area (Sq. m)	Percent beneficiaries who used the tillers (%)	Percent time saved over desi plough by the tillers (%)	Percent man power saved using power tillers over desi plough (%)	Avg. Diesel required (lit)	Increase in Field Capacity, of power tillers over desi plough (%)	Saving of cost of operation over desi plough (%)
Samrat SHG	5437.5	100	38.5	50	9	14.7	59.1
Karmgal SHG	4875	82	8.3	50	5.6	64.0	52
Sai Nath SHG,	4091	100	11.1	50	7	48.1	50
Nakeripurush Mahila SHG	7161	38	9.1	60	3	140.9	52.4
Shivnath SHG	3114	83	-11.1	33.3	5	Tiller used previous year too	
Devi SHG	19091	64	25.9	50	10	111.7	44.7
Garvaipurush SHG	2659	91	50	40	3	Tiller used previous year too	
Bhars farmer Group	5000	92	37.5	46.6	8	41.7	47.1

Table 3: Impact Assessment for Power reapers

Self Help Group	Farmer who used the tiller (%)	Time saved over manual harvesting (%)	Manpower saved in over manual (%)	Avg. Diesel required (lit)	Increase in Field Capacity over manual harvesting (%)	Decrease in cost of operation (Rs/acre), over manual harvesting (%)	Remark	
Samrat SHG	36	14.3	83.3	4	912.8	82.9	Operation difficult and cumbersome due to hilly terrain and bunds for water stagnation within the fields.	
Karmgal SHG	91	-		3	-	-		
Sai Nath SHG,	50	50	50	3	58.1	57.8		
Nakeripurush	54.5	0	33.3		98.03	65.6		
Mahila SHG								
Shivnath SHG	42	28.6	37.5		102.2	60.3		
Devi SHG	Operation difficult and cumbersome due to hilly terrain and bunds for water stagnation within the fields.							
Garvaipurush SHG	Heavy lodging of crop due to rains at harvest time, hence reaper could not be used.							
Bhars farmer Group								

the farmers' groups. Out of the eight beneficiary groups it was found that 3 existed before and 5 were registered only after they came to know about the scheme to avail its benefit. Since farmer clubs and SHGs are cost cutting mechanisms of grassroots level technology transfer and also aimed to multiply the impact in the field, we can consider this as one positive effect of the project.

The machinery have helped in the capacity building of the beneficiary farmer groups an aspects like (i) Source of income for the beneficiary groups, (ii) A bank account in which they are depositing this income and using it for servicing of the equipment and also for their fuel cost and or operator cost etc. for operating the equipment, (iii) Strength in Management and also the interaction between the members has increased as they are conducting regular monthly meetings and also recording the attendance of members and proceedings in a register, (iv) Book keeping practice has also been inculcated in the group as all of them were maintaining proper record of money and equipment usage etc., (v) Bonding has improved between the members (vi) Wider impact on the community

was found as new groups were registered to avail the opportunity provided by the project in the next year, (vii) Other non-members from the village also could make use of the equipment at subsidized rates., (viii) Thus the overall impact of the equipment provided on the community and its development has been found to be very positive.

Agronomical Impact:

The equipment were distributed in June 2011 and the impact assessment done in December 2011 for power tillers and other equipment and March 2012 for paddy reaper and again for all equipment in 2015.

The power tiller was used by the beneficiary farmers for tilling, puddling and bund forming and the average field capacity for the different groups is summarized in Table 4. It was observed that 64.5 to 100% beneficiaries of the various groups shifted to using power tillers instead of desi plough for ploughing, puddling and bund making. Thus it was observed that the average requirement of manpower decreased by 33.3% to 60% over desi plough in the beneficiaries, while the

Table 4: Estimated area cropped using the power tillers

Name of group	Total h used in a year	Average field capacity of group (Ha/h)	Total estimated area cropped (Ha)
Bhars farmer SHG, Bhars, cancona	46.5	0.1	4.65
Devi SHG, Cotigaon Yedawada, Cancona	329	0.1	32.9
Garvaipurush SHG, Kindalkatta ward Gadongarim, Cancona	49.5	0.09	4.455
Karmgal SHG, Gadongarim, Cancona	165	0.08	13.2
Nakeri Purush Mahila SHG, Cotigaon Awemwado, Cancona	48.5	0.07	3.4
Sai Nath SHG, Karvem, Cancona	78.5	0.05	3.93
Samrat SHG, Morpirla, Quepem	112	0.06	6.72
Shivnath SHG, Kidamkarwada, Gadongarim, Cancona	46.5	0.03	1.4
Total	71.2		

average field capacity increased by 41.7 to 141 % over desi ploughs for the various operations leading to an average cost saving of 44.7% to 59.1% .

The power tillers were used for a maximum of 329 hours by Devi Self Help Group and minimum of 46.5 hours by Shivnath Self Help Group (including hours given on rent to outside members) and the corresponding average field capacity was 0.1 and 0.03 Ha/h. The estimated cropped area based on the hours of usage and the average field capacity of the group is also given above in Table 4. Thus on an average the power tillers were used for 13.7 days in one year. This is considerably less than the general usage of a power tiller which is 48 days as reported by Doss *et al.*, (2004). The reasons for this may be the wrong or under-reporting of the hours of rental by the farmers.

The other reason could be that paddy is mostly cultivated only in the *kharif* in these areas due to lack of irrigation facility during the *rabi* season when mostly small areas are used for vegetable cultivation and most of the work is concentrated on plantation crops. But clearly there was a significant shift in the adoption of the power tiller as out of 108 farmers only 14 (13%) stuck to the traditional bullock based *desi* plough. There was no scope for increasing the cropped area or the cropping intensity as the land-holdings' size was fixed due to lack of irrigation for bringing more area under cultivation. But the farming operations could be completed on time and also savings could be achieved due to lesser labor requirement (Table 2 and Table 2). It was observed that the vegetable area during Rabi which was an average of 200 to 500 sq.m. increased to an average of 200 to 4000 sq.m. (Table 3) with introduction of mechanization.

Self-Propelled Paddy Reaper

Most of the farmers were aware on how to use the power tiller, but not about the paddy reaper. Hence, with the help of VST manufacturer and M/s Goa tractors, hands-on training was given for the operation and maintenance of the Paddy reaper. In spite of this only 27.8 percent (01 to 91% of individual group beneficiaries) of the beneficiaries actually used the power reapers, due to various reasons such as drudgery of operation in the narrow farm holdings, undulating and slopy land making access impossible, lack of access roads, lodging of crop due to excess rainfall at the time of harvest, etc. But some groups gave the reapers on hire to the low land farmers of Karwar in the neighboring state of Karnataka at a high rate of Rs. 400/h and made a lot of profit. However, the width of 120 cm was a constraint on the *morod* lands as the farmers found their use full of drudgery. Wherever the groups used the reapers a time saving of 0 to 50%, manpower saving of 33.3 to 83.3%, increase in field capacity of 58.1 to 912.8% and saving in cost of 57.8 to 82.9% as compared to manual harvesting was observed.

Mini Rotary Tillers and Brush cutters

In the hilly topography of Morpirala the mini rotary tillers were preferred over the power tillers for tilling and puddling and as they were easy to maneuver in the narrow landholdings on slopes. But there were frequent breakdowns by to rotavator

damage due to rocks in the field, oil leakage into engine when maneuvering on slopy land *etc* for which the farmers had to be sensitized. The brush cutters were used for clearing weeds and trimming the cashew trees in the plantations. The brush cutters also generated income through custom hiring.

Financial Impact

Under the tribal sub plan scheme of GOI, the power tillers and other equipment were given absolutely free of cost to the tribal farmers with necessary accessories and along with three free servicing. The farmers were given training on the use of the machinery, to maintain log books and do proper servicing on schedule according to hours of usage and also save and generate money through custom hiring. The farmers were told that they could use these savings for oil change, servicing and maintenance of the equipment, meet fuel and operator expense wherever necessary. Five groups gave the power tillers on hire the first year, but over the years the increase in mechanization reduced the total hours of custom hiring per year. The power tillers were making earnings through custom hiring at varying rates i.e. Rs. 200-250/h (Table 5).

Table 5: Earnings from Custom Hiring of Power Tillers in a year

Name of group	No of non-members used the power tiller	Hours used	Income (assuming average of Rs.225/hr.)
Garvaipurush SHG	5	20	4500.00
Karm gal SHG	15	108	1605.00
Sainath SHG	5	15	3375.00
Sainath SHG	10	18	4050.00
Shiv nath SHG	12	15	3375.00

The beneficiaries were reluctant to share the information on right jumped actual earning got through renting of the farm equipment and hence the earnings reported are on the lesser side.

CONCLUSIONS

The mechanization program for small and marginal tribal farmers of Goa of ICAR-CCARI was able to make a significant Impact on the tribal Paddy farmers of Goa resulting in formation of new farmer groups and strengthening of the existing groups and also improving the farming conditions of The beneficiaries through timely operations, labor, time and cost saving and generating extra income through renting the equipment to non-members. Proper training and sensitization by involving local NGOs and kisaanmitras etc. was necessary. Also mechanization projects have to go hand in hand with infrastructure development like access roads, irrigation system, service centers etc. to amplify the effects of mechanization.

This has been a small step in the right direction and the project's initial success resulted in a total of Rs. 1,85,22,056 being spent for distribution of 57 power tiller, 49 Mini rotary tillers, 24 brush cutters, 23 threshers, 23 winnowing fans and 8 self-propelled power reapers benefitting 57 tribal farmer groups and tribal women self-help-groups of Goa.

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