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OUR CONTRIBUTORS

Palak H. Mehta	Research Scholar, Department of Economics, Gujarat Vidhyapith, Ahmedabad
Kinjal Ahir	Department of Economics, Sardar Patel University, Vallabh Vidyanagar
Manish Makwana	Agro-Economic Research Centre, Sardar Patel University Vallabh Vidyanagar
H.P. Trivedi	Department of Economics, Sardar Patel University, Vallabh Vidyanagar
Parimalsinh Chavda	Research Scholar, Department of Economics, Sardar Patel University, Vallabh Vidyanagar
Sonal Bhatt	Department of Economics, Sardar Patel University, Vallabh Vidyanagar
Gur Gaurav Singh	Assistant Engineer, PSPCL, Punjab-144001
Shaveta Kohli	Department of Economics, Central University of Jammu, Samba, Jammu and Kashmir-181143
Dipal R. Patel	R. N. Patel Ipcowala School of Law and Justice, Vallabh Vidhyanagar, Gujarat

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Comparative Economic Analysis of Banana Farming under Drip and Flood Irrigation in Narmada District of Gujarat

Palak H. Mehta¹

Abstract

Banana is a very popular fruit due to its low price and high nutritive value. It is an important fruit crop grown in India next to mango. (GoG, 2011) Banana is highly water consuming horticultural crop. According to 2016-17 in Gujarat 66.3 thousand hectares area is under banana crop. From which 19.85 thousand hectares area cultivated under drip-irrigation and 46.45 thousand hectares area is cultivated under flood irrigation in banana crop. (GGRC, 2018)

Compared to flood irrigation method, drip irrigation method is saving 45 percent of the water and also increases yield up to 52 percent in banana crop. (GoI, 2016) So, weather to see drip irrigation is beneficial or not for farmers, study have been carried out for 150 banana cultivated farmers from Narmada district. Out of them 75 use drip irrigation and 75 use flood irrigation method. Here study of cost and returns of two years 2014-15 for Main crop and 2015-16 for Ratoon crop of banana. It has been found that farmers, who use drip irrigation gain more net profit per acre than flood irrigation method in banana cultivation. By Cobb - Douglas production function, it has been known that in drip irrigated banana there is scope to increase the output by maximum use of input than flood irrigation.

Key word: *drip and flood methods of irrigation, production, economics, banana*

JEL: *Q15, Q25*

Introduction

Agriculture is the predominant occupation of the majority population in rural India. Sustained agricultural growth continues to be the key to poverty alleviation and overall economic development of the country. Horticultural crops have more crop yields and revenue per acre than other crops. Fruits and vegetables provide three to four times more cash income than any other cereals per unit of land, in addition to acting as prime sources of vitamins and minerals. (Hanumantharaya, Kerutagi, Patil, Kanamadi, & Bankar, 2009) According to 2014 India is the second largest producer country of fruits and vegetables. (GoI, 2016)

Banana is the most important fruit crop in India and accounts for 32.7 % of the total fruit production. (GoI, 2016) The important banana growing states are Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh, Karnataka, Bihar and Madhya Pradesh, which together accounted

¹ Research scholar at Department of Economics, Gujarat Vidhyapith, Ahmedabad (palakhm89@gmail.com)

for about 87.01 percent of total banana production in the country. (Dave, Zala, & Pundir, 2016) According to the production Gujarat state is ranked first with a share of 15 percent of overall production. (2016-17).

The agricultural sector (irrigation), which currently consumes over 80 percent of the available water in India, continues to be the major water consuming sector due to the intensification of agriculture. (Saleth, 1996) Though India has one of the largest irrigated area in the world, the coverage of irrigation is only about 40 percent of the gross cropped area as of today. One of the main reasons for the low coverage of irrigation is the predominant use of flood method of irrigation. (Dave A. K., 2011)

The drip irrigation technology introduces first time in the world by Israeli engineer Symca Blass in 1940. (Sonawane, 2010) Drip irrigation is the most efficient and new technology of irrigation to supply precise amounts of water directly into the vicinity of root zone at the right time, matching with the consumptive water demand of plant for optimum growth, improved yield and quality of produce with substantial water saving. (Kumar, Sharma, & Raina, 2005) Banana requires large quantities of water during its life cycle. Drip irrigation in banana plantations has helped in saving water and offers a great promise, owing to precise and direct application of water in the root of the plant. (Agrawal & Agrawal, 2005)

According to the year 2015, total area of 42.3-thousand-hectare area in Gujarat is under drip irrigation method. (GoI, 2016) But still there is a large area which cultivates with flood irrigation. So, it is very important to compare the banana cultivation with these two methods.

Hence, the present study was conducted with the following objectives:

1. Compare to the cost and returns under drip irrigation banana and flood irrigation banana cultivation.
2. To assess the resource use efficiency under drip irrigation banana and flood irrigation banana cultivation.

Methodology

The present study has been carried out in Gujarat's Narmada district. Out of five talukas of the district, lands and weather of Nandod Taluka are more favorable for banana crop, hence nearly total 78.57% area of the district banana cultivation happens in Nandod Taluka. (GoG, 2014-15) For this study, 75 drip and 75 flood irrigated banana growers selected from ten selected villages of Nandod Taluka. Farmers take two crops from banana plantation. First as a Main crop and second as a Ratoon crop. Ratoon cropping simply means the second and subsequent crop from the suckers. So, the cost and income of these two crops have been taken into account. The primary data for the study were collected through personal interview method with the help of pre - tested questionnaire. In the study, 10th part of cost for installation of the drip irrigation method has been counted because the life of drip irrigation is at least 10 years after the installation as per the farmer's opinion.

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Data was analysed using both table and functional analysis. Tabular analysis was adopted to study the resource use structure, cost, returns, profits and the opinion of the farmers regarding problems in production. Simple statistical tools like averages and percentages were used to interpret the results properly.

Cost of cultivation included variable costs and fixed costs. Variable costs included the cost of human labour, seeds, manure, irrigation, fertilizers, etc. Fixed costs comprised depreciation, land revenue, rental value of land and interest on fixed capital.

An attempt is made to examine the effects of variation in major agricultural inputs on crop yield with the help of a log-linear regression model which is estimated for both for drip and flood method banana cultivation. The log-linear regression model is used to find out the contribution of each factor to production of under drip and flood irrigation in banana crop. The regression model is stated with a log-linear functional form due to the fact that the agricultural production function is usually assumed to follow a Cobb-Douglas type production function that requires a log-linear transformation for estimation of input co-efficient. Thus, the estimable equation is as follows:

$$Y = a \cdot X_1^{b_1} \cdot X_2^{b_2} \cdot \dots \cdot X_n^{b_n} \cdot e^i$$

Where,

Y= dependent variable

X1 to X6 = independent variable

a= constant representing intercept of production function

bi= Regression coefficient of the respective resource variable

eⁱ = Error term

For a fitting production function in both drip irrigated and flood irrigated banana cultivation methods, six inputs (variable) were considered as important factors, by considering the problem of multicollinearity in estimating production function and equation fitted was of the following formula.

$$Y = a X_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6}$$

The function was transformed into linear form by making the logarithmic transformation of all the variables as follows.

$$\text{Log } Y = \text{Log } A + b_1 \text{Log } X_1 + b_2 \text{Log } X_2 + b_3 \text{Log } X_3 + b_4 \text{Log } X_4 + b_5 \text{Log } X_5 + b_6 \text{Log } X_6$$

Where,

Y= Per acre production

A= Constant term

b1, b2... b6 = Regression co-efficient

- X_1 = Area of banana (acer)
 X_2 = number of suckers
 X_3 = number of irrigation
 X_4 = cost of chemical fertilizers
 X_5 = cost of manures
 X_6 = cost of Human Labour

Results and Discussion

1) Tabular Analysis

Per acre cost of production of banana under the drip and flood method of irrigation is presented in the table 1.

Table 1 : Per acre total cost of cultivation of banana for drip and flood irrigation method

sr.n	Items of cost	Banana cultivation with drip irrigation method				Banana cultivation with flood irrigation method			
		Main crop		Ratoon crop		Main crop		Ratoon crop	
		Value (Rs)	% of total cost	Value (Rs)	% of total cost	Value (Rs)	% of total cost	Value (Rs)	% of total cost
1	Human labour cost	10543	10.4	6622	10.2	16769	16.6	11597	18.1
2	Tractor cost	1722	1.7	0	0.0	1822	1.8	0	0.0
3	Sucker cost	3999	4.0	0	0.0	3543	3.5	0	0.0
4	Irrigation installation cost	4002	4.0	4898	7.5	0	0.0	0	0.0
5	Water cost	0	0.0	0	0.0	3963	3.9	1944	3.0
6	Electricity cost	6194	6.1	5726	8.9	941	0.9	1119	1.7
7	Manure cost	8874	8.8	0	0.0	7053	7.0	0	0.0
8	Fertilizer cost	12452	12.3	10031	15.5	13056	12.9	10437	16.2
9	Maintenance cost	11891	11.7	1191	1.8	12510	12.4	1018	1.6
10	Harvesting cost	4967	4.9	4749	7.3	4920	4.9	4717	7.3
11	Interest on working capital	5218	5.2	2779	4.3	5489	5.4	2726	4.2
12	Other cost	6152	6.1	6485	10.0	7893	7.8	8118	12.6
	Total variable cost (1 +12)	79756	75.2	42481	65.6	83903	77.3	41676	64.8
13	Land revenue	13781	13.6	12556	19.4	14986	14.9	14875	23.2
14	Interest on fixed capital	9090	9.0	9090	14.0	7514	7.5	7514	11.7
15	Depreciation cost	2178	2.2	620	1.0	371	0.4	212	0.3
	Total fixed cost(13 + 15)	25050	24.8	22266	34.4	22870	22.7	22601	35.2
	Total cost	104806	100	64747	100	106773	100	64277	100

Source: Author's own calculation

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From Table No 1 it could be seen that in Main crop per acer total cost of cultivation of drip irrigated banana was less (1,04,806 Rs.) than by flood irrigated banana (1,06,773 Rs.).

Also, the total variable cost of drip irrigated banana was less (Rs. 79,756) than by flood irrigated (Rs. 83,903) banana per acer. The farmer's total variable cost is more in flood irrigation than drip irrigation because of increasing per acer labour cost, water cost and cost of maintenance (pesticide, insecticide and weedicide, support cost) in banana cultivation.

The banana cultivation by drip irrigation involves electricity cost, which in the flood irrigation method is negligible. Analysing the total fixed cost, it seems that farmers of the flood irrigation method (Rs. 22,870) would be benefited from the drip irrigation method (Rs. 25,050). Because the depreciation cost of drip irrigation comes more.

Thus, cost of cultivation with flood irrigated method per Main crop of banana is more than drip irrigated method because variable cost is more in flood irrigated method.

While in Ratoon crop, total variable costs of drip irrigation method (Rs. 42,481) and total fixed cost (Rs. 22,266) which is more than the flood irrigation method, i.e. variable cost (Rs. 41,676) and total fixed cost (Rs. 22,601). So, the total cost of Banana cultivation of drip irrigation method in Ratoon crop is more than the banana cultivation cost of flood irrigation method.

While the cost of both crops is accumulated from the cost of cultivation, the total cultivation cost of two crops of drip method (Rs.1,69,553) is less than the total cultivation cost of two crops with flood method (Rs.1,71,050).

Table 2 : Yield and returns of banana cultivation from drip and flood irrigation method

Sr. No	Particulars	Banana cultivation with drip irrigation method		Banana cultivation with flood irrigation method	
		Main crop	Ratoon crop	Main crop	Ratoon crop
1	Production (Quintal/acre)	259	197.2	224	187.4
2	Price received (Rs/Quintal)	995	880	988	850
3	Income (Rs/acre)	257705	173536	221312	159292
4	Cost (Rs/acre)	104806	64747	106773	64277
5	Net profit (Rs/acre)	152899	108789	114539	95015

Source : Author's own calculation

Returns in Main crop and Ratoon crop with drip and flood irrigation method from banana cultivation to the farmers shown in Table 2. It can be seen here that during the Main crop, the yield per acre cultivation of the drip irrigation method is 15.6% more than the flood irrigation method. As well as in drip irrigation, farmers can get 7 rupees per quintal more as

compared to the flood irrigation method. In Main crop, farmers of drip irrigated method get 33% net profit per acre compared to farmers of flood irrigation method.

When in Ratoon crop, compared to farmers cultivating banana with flood irrigation method, drip irrigation method yields more than 5.2% per acre. They can also get 30 Rs. per quintal more than flood irrigation method. Therefore, farmers who use a drip irrigation method acquires 14.4% net profit per acre as compared to those farmers who use flood irrigation method.

2) Functional analysis

Table 3 : Production elasticity of drip and flood irrigation method as estimated from Cobb-Douglas production function

Variables/Method	Banana cultivation with drip irrigation method	Banana cultivation with flood irrigation method
Adjusted R Square	0.705	0.739
a= (Constant)	-11.590 (.000)**	.077 (.947)
X1= area under crop (Acer)	.003 (.750)	-.002 (.640)
X2= number of suckers (seed)	4.463 (.000)**	.497 (.005)**
X3=number of irrigation	-3.046 (.067)	.061 (.509)
X4= manures cost	.229 (.002)**	.037 (.244)
X5= chemical cost	.135 (.021)*	.358 (.000)**
X6= cost of labour	.003 (.889)	-.020 (.647)
Returns to scale	1.79	0.93

Note: Figures within the parentheses indicate a significant value of corresponding elasticity.

** Significant at 1 % level & *Significant at 5 % level.

Resources use efficiency for the drip and flood irrigation methods are separately estimated and the result is presented in table 3.

The co-efficient of multiple determination (R²) is 0.705 for drip irrigated banana, which indicates that 70.5 percent of total variation in the production is explained by the six variables for functional analysis. The co-efficient of number of suckers (x₂) and manure cost (x₄) are found positive and significant at 1 percent level. Which indicates that quantity of seeds and cost of manures are the most important variable determining the production of drip irrigated banana. It indicates that with 1 percent increase in the use of number of suckers and cost of manures in cultivation of drip irrigated banana, production would go up by 4.46 percent and 0.22 percent respectively. The co-efficient for cost of chemical fertilizer (x₅) is found positive and significant at 5 percent level. Which indicates that cost of chemical fertilizer is affecting significantly on

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production of drip irrigated banana, and it will increase with increase in cost of chemical fertilizer. While the co-efficient for constant is found negative and significant at 1 percent level. Which indicates that, except these six variable other variables affecting negative and significantly on production of drip irrigated banana. The production level will increase with decline in constants variables. Further, co-efficient of area (x1), irrigation (x3) and labour (x6) are non-significant at 5 percent level.

The co-efficient of multiple determination (R^2) is 0.739 for flood irrigated banana which indicates that 73.9 percent of total variation in the production is explained by the six variables for functional analysis. The co-efficient of number of sucker (x2) and cost of chemical fertilizer (x5) are found positive and significant at 1 percent level. Which indicates that quantity of suckers and cost of chemical fertilizer are the most important variable determining the production of flood irrigated banana. It indicates that with 1 percent increase in use of number of suckers and cost of chemical fertilizer in cultivation of flood irrigated banana, production would go up by 0.49 percent and 0.35 percent respectively. While the co-efficient of constant, area (x1), irrigation (x3), manure (x4) and labour (x6) are non-significant at 5 percent level.

Returns to scale

In Cobb-Douglas production function the returns to scale is obtained by the summation of elasticity co-efficient (S_{bi}) of the independent variables.

If $\sum b_i > 1$ it is increasing returns to scale

If $\sum b_i = 1$ it is constant returns to scale and

If $\sum b_i < 1$ it is decreasing returns to scale.

In study- area, the value of S_{bi} is 0.93 in the flood irrigation banana which indicates decreasing returns to scale, while S_{bi} is 1.79 in the drip irrigation banana which indicates increasing returns to scale. Therefore, there is scope to increase production by using maximum production tools.

Conclusions

In the Narmada district, comparison of banana cultivation by drip irrigation method and flood irrigation method shows that,

1. Even though the initialization cost is high, the drip irrigation method is more beneficial than flood irrigation method. Because once it is applied, it last for at least ten years according to farmers experience. So, considering the cost of 1 years (10th part of total installation cost), the drip irrigation method is proven to be cheaper than the flood method. Also, the flood method incurred high cost of labour to the farmers.
2. Compare to the cost of banana cultivation of Main and ratoon crops from both irrigation methods seems that in flood irrigation method expenditure is more than 0.88 % per acer by the drip irrigation method.

3. As compared to the flood irrigation method, banana cultivated by drip irrigation method production is more than 15.6% per acre. So, by adopting the drip method in Main crop and Ratoon crop approx. 33.4% per acres and 14.4% per acre, respectively more profitable.
4. Compare to the banana cultivation of Main and ratoon crops from both irrigation methods seems that in drip irrigation method production and profit is more than 10.89% and 24.88 % per acer by the flood irrigation method respectively. Thus, farmers will be more beneficial if they use drip irrigation method.
5. In Narmada district, under flood irrigation method for banana cultivation reveals the decreasing returns to scale. Where even though increasing the input proportion, the rate of production is changing by the decreasing proportion. While in drip irrigation method for banana cultivation reveals the increasing returns to scale. Where even though increasing the input proportion, the rate of production is changing by an increasing proportion. So, in the method there is scope to increase the output by maximum use of inputs.

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Trends in Food Grains Production in Gujarat Since Independence

Kinjal Ahir¹, Manish Makwana² and H. P. Trivedi³

Introduction

The state of Gujarat is one of the most economically advanced states of India. In 2014-15, Gujarat ranked fourth after Maharashtra, Tamilnadu, and Uttar-Pradesh in terms of Gross State Domestic Product at factor cost (at constant prices with base year 2011-12) (RBI, 2017, p 48). In 2014-15 Gujarat ranked fifth among all the states of India in context of the Gross State Value Added (GSVA) from agriculture and allied sector at constant (2011-12) prices with Rs. 1,16,45,044 lakh (MAFW, 2017a, p 41). The growth rate in the Net State Domestic Product (NSDP) agriculture, for Gujarat was observed to be highest at 11.5 percent among various states for 1999-2000 to 2008-09 at 2004-05 prices (Chand and Parappurathu, 2012). However, the percentage share of agriculture (including crop and livestock sector) in total GSVA at constant prices (2011-12) in 2014-15 was 15.16 percent, about half the percentage of the state with highest percentage share of 30.44 percent for Madhya Pradesh (MAFW, 2017a, p 47). Shah (2011) also observed that even though the rate of growth of agriculture in Gujarat particularly in the last decade, 2000-2010, was phenomenally high, but its share in the state domestic product was lesser than that for all India level. For the period during 2000-2010 the favorable irrigation and complementary conditions resulted into higher production of high value crops like cotton, oilseeds, spices, fruits and vegetables (Shah, 2011). During 2015-16 Gujarat ranked the highest in India in terms of production of groundnut and cotton and third highest in terms of total production of oilseeds (MAFW, 2017a). In Gujarat in 2015-16, 3.16 million hectares of land was under the production of food grains, engaging a meager 2.56 percent of the overall land under the production of food grains in India. The production of food grains in Gujarat accounted for 6.23 million tons in 2015-16, 2.47 percent of the overall food grain production in India. Yield for food grains production in Gujarat in 2015-16 was 1973 kg. / hectare (MAFW, 2017a). Gulati, Shah and Shreedhar (2009) observed that since 2000 cereals and pulses grew at 11 percent per annum in terms of value, amidst fluctuations. There is a lot of discussion in the existing literature regarding the phenomenal growth observed in the agriculture sector in Gujarat, particularly during 2000-2010 and the reasons thereby (Shah et al, 2009; Gulati, Shah and Shreedhar, 2009; Kumar et al 2010; Mehta, 2012; Pattnaik and Shah, 2013, 2015). Among various reasons cited for high agricultural growth rate include innovative agriculture development (public policies like Krushi Mahotsav, Agricultural Universities, Kisan Credit Cards), liberalized markets and strong agricultural marketing institutional network (amendments in

¹ Associate Professor, P.G. Department of Economics, Sardar Patel University, Vallabh Vidyanagar & Hon. Deputy Director, Agro-Economic Research Centre, Vallabh Vidyanagar

² Research Associate, Agro-Economic Research Centre, Vallabh Vidyanagar

³ Head, P.G. Department of Economics, Sardar Patel University, Vallabh Vidyanagar

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Agricultural Produce Market Marketing Committee - APMC and farmer's cooperative organizations, retail chains), private investment and spread of new technological inputs (like in technological innovation in Bt cotton), enhancement of agriculture reinvention, improvement in rural infrastructure particularly associated with agriculture like irrigation (by Gujarat Green Revolution Company Ltd.), power (Jyotigram scheme) and roads (Pradhan Mantri Gram Sadak Yojana scheme, NABARD assisted road constructions and Gujarat State Highway projects); farm power reforms; ground water recharge in Saurashtra and Kutch among others (Mathur and Kashyap, 2000; Gulati, Shah and Shreedhar, 2009; Shah, 2011; Shah et al 2009 as cited in Chand and Parappurathu, 2012). Such factors enhanced the production of high value agricultural output and facilitated multi-cropping.

This research paper is an attempt to analyze the trends related to food grains production in Gujarat since independence. Firstly, the overall current scenario of agriculture in Gujarat is observed based on selected attributes. It is followed by the observations related to total area under food grains production, production, and yield in Gujarat with regards to the categorization of different periods' since independence. Then the observations related to area, production, and yield of different cereals and pulses follow separately for major cereals and pulses produced in Gujarat during various periods and the changes thereby since independence. Consecutively, a comparative findings and analysis for the area under production, production, and yield for all cereals and pulses across different periods since independence, follows.

1. Data Collection and Methodology

Agricultural production largely comprises of cereals (like rice, wheat, bajra, maize), pulses (like gram and tur), oilseeds (like groundnut, castor, sesame seeds, soyabean, sunflower, rapeseed and mustard), horticulture (like fruits and vegetables, spices) and various cash crops (like sugarcane, cotton, jute, tobacco). Cereals and pulses are collectively termed as food grains. The agricultural output performance is measured basically through three indicators namely area covered under agricultural production (in hectares), production (in Million tons) and yield or productivity (in kilograms per hectare). Further, MAFW (2017b) categorized the time since independence in context of agricultural developments in India into 6 different periods. They are 'Pre-green revolution period' (from 1960-61 to 1968-69), 'Early green revolution period' (from 1968-69 to 1975-76), 'Wider technology dissemination period' (from 1975-76 to 1988-89), 'Period of diversification' (from 1988-89 to 1995-96), 'Post-reform period' (from 1995-96 to 2004-05), and 'Recovery period' (from 2004-05 to 2012-13). The research paper uses the same nomenclature and categorization as discussed above. Largely the production of food grains cover the maximum area and produces maximum output amongst various agricultural outputs like oilseeds, cash crops, or horticulture in India as well as in Gujarat. Hence the current research paper exclusively focuses on the production related aspects of selected food grains in Gujarat since independence.

The current research largely used the secondary data available from Ministry of Agriculture and Farmers Welfare, Government of India and Directorate of Agriculture, Agriculture, Farmers Welfare and Co-operation Department, Government of Gujarat. Besides, various

research papers, books, and websites were referred. Line charts and the graphical linear trend-lines were used for the analysis. Trend lines were used for the analysis of area under production, production, and yield for selected food grains, cereals and pulses in total and separately for major food grains and pulses. Separate graphs for food grains, cereals and pulses as aggregate and separately for major cereals and pulses are displayed, but the graphs for comparative analysis of the area under production, production, and yield for selected food grains and pulses have been used for analysis but not displayed here. For the sake of lesser complex display, the linear trend-lines have not been shown in the graphs. Growth rates for area under production, production, and yield have been calculated for different periods as categorized by MAFW (2017b) since independence. Growth rates have been calculated for food grains, cereals and pulses in total and major cereals and pulses separately using log-linear method.

2. Overall scenario of agriculture in Gujarat

The population of Gujarat was about 604 lakhs in 2011, with about 289 lakh females and about 314 lakh males. The decadal population growth rate reduced from 22.66 for 1991-2001 to 19.28 for 2001-2011. According to the Ministry of Agriculture and Farmers Welfare (MAFW, 2017a) in 2011, Gujarat had about 54.48 lakh cultivators (4.59 percent of total cultivators in India) and 68.39 lakh main and marginal agricultural laborers (4.74 percent of total main and marginal agricultural laborers in India). Out of the total cultivators in Gujarat, about 52.52 lakh cultivators belonged to rural areas (96.4 percent) and about 1.96 lakh cultivators belonged to urban areas (3.6 percent). About 42.44 lakh cultivators were male (77.92 percent) and about 12.03 lakh cultivators were female (22.08 percent). Besides, in 2011 out of 68.39 lakh agricultural laborers employed in agriculture as main and marginal workers in Gujarat, about 64.81 lakh laborers belonged to rural areas (94.76 percent) and 3.58 lakh laborers belonged to urban areas (5.24 percent). 36.5 lakh agricultural laborers were male (53.36 percent of agricultural laborers) and about 31.89 lakh laborers were female (46.64 percent of agricultural laborers).

In 2013-14 the Net Sown Area for Gujarat was 10302 thousand hectares, and the total cropped area was 12487 thousand hectares. The cultivable land was 12661 thousand hectares. Hence the cropping intensity was 121.2 that were lower than the cropping intensity for all India at 142 in 2013-14. The overall average size of land holding in Gujarat was 2.03 hectares in 2010-11, higher than that for India's average at 1.15 hectares (MAFW, 2017a). 46.1 percent of Gujarat was under irrigation in 2013-14 as compared to 98.8 percent of area covered under irrigation in Punjab that had the largest area under irrigation among major states and 18.6 percent in Maharashtra on the lower side (MAFW, 2017a). Additionally it should be noted that Gujarat is referred to as a chronically drought prone area and has one of the highest drought probability with erratic and uneven rainfall (Mathur and Kashyap, 2000). Availability of water and irrigation facilities is detrimental for agricultural growth (Kumar et al, 2010). Gujarat faced certain years of drought or famine since independence, like 1968-69, 1985-87 and 1999-2000. Particularly the Saurashtra & Kutch region recorded the second highest (after West Rajasthan) frequency of

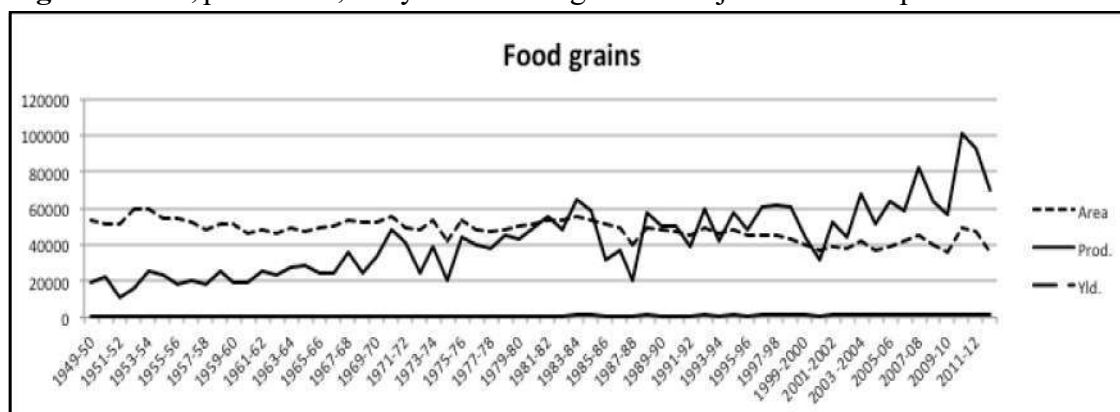
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moderate and severe drought during the period from 1875 to 2004 (IMD, 2005). Besides the 'post-reform period from 1995-96 to 2004-05' in agriculture, coincided with the 2001 Bhuj earthquake, thereby affecting the socio-economic output of the state including agriculture.

3. Production of food grains in Gujarat

Food-grains comprise of cereals and pulses. Major cereals cultivated in Gujarat included rice, wheat, jowar, bajra, maize, and ragi. Similarly, major pulses cultivated in Gujarat included gram and tur. The percentage share of food grains on the basis of the average production over the period 2008-09 to 2012-13 were for wheat 44.36 percent (of the total food grains produced in Gujarat for the same period), rice 19.73 percent, bajra 15.55 percent, maize 9.3 percent, jowar 2 percent, ragi 0.2 percent, tur 3.4 percent and gram 2.37 percent. Figure 1 shows the area under production, production, and yield for total food grains in Gujarat since independence.

Figure 1: Area, production, and yield for food grains in Gujarat since independence



Source: DoA, 2017

The area under the food grain production in Gujarat reduced from 3.53 million hectares in 2014-15 to 3.16 million hectares in 2015-16. The food grain production in Gujarat was 7.11 million tons in 2014-15 that reduced to 6.23 million tons in 2015-16. The area under production for food grains and its yield during the first phase of green revolution fluctuated greatly in Gujarat (Chand and Raju, 2008). Likewise, the production of food grains in Gujarat as a percentage of food grains production in India reduced from 2.82 in 2014-15 to a meager 2.47 in 2015-16. The share of the value of food grains as a percentage of total agricultural production was observed to have declined since 1994-95 (Dixit, 2009). Yield for food grain production in Gujarat in 2014-15 was 2016 kg/hectare (as compared to 2028 for all India) that reduced to 1973 kg/hectare in 2015-16 (as compared to 2056 for all India) (MFAW, 2017). Bagchi, Das and Chattopadhyay (2005) observed a meager or even negative growth rates in the area and production of food grains particularly during 1980-81 to 1990-91 and 1990-91 to 2000-01, particularly for rabi crops.

However, as can be observed in Figure 1, a rising trend in the overall production of food grains was observed since independence, even though the trend in the area under the

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production of food grains depicted reduction, as was also observed by Mehta (2012). Trend in the productivity/ yield in Gujarat food grains production as measured by the quantity of production in kilograms per hectare largely remained stable since independence.

It can also be observed from Table 1 that the growth rates for area under food grains largely remained negative from 1968-69 to 2004-05 spanning across the pre green revolution period up to post reforms period. Slight recovery in the growth rate in the area under production of food grains could be observed in the recovery period (with growth rate of 1).

Table 1: Growth rates in area, production, and yield across various periods for selected food grains since independence in Gujarat

Crop	Indicators	Different Periods (refer to note below the table)						
		1	2	3	4	5	6	7
Total food grains	Area	1.59	-1.28	-0.33	-0.73	-2.26	1	-0.47
	Production	3.39	0.6	-1.02	-0.82	-0.61	5.2	2.23
	Yield	1.77	1.91	-0.69	-0.1	1.69	4.16	2.71
Total Cereals	Area	2.01	-1.54	-0.95	-0.7	-2.26	1.12	-0.72
	Production	3.96	0.53	-1.41	-0.7	-0.37	5.47	2.18
	Yield	1.92	2.1	-0.46	0	1.93	4.31	2.93
Wheat	Area	4.47	-0.35	-2.02	1.15	-0.37	5.37	1.39
	Production	11.08	3.81	-0.27	1.65	0.72	7.48	4.07
	Yield	6.34	4.17	1.78	0.49	1.09	2	2.64
Bajra	Area	4.12	-1.64	-0.48	-1.95	-3.02	-3.9	-1.25
	Production	9.29	-3.66	-1.32	-3.27	-0.9	1.94	1.70
	Yield	4.97	-2.04	-0.85	-1.34	1.9	6.44	2.98
Rice	Area	-1.26	-2.1	1.33	3	-1.12	1.65	0.80
	Production	-1.01	-2.24	0.48	2.85	-1.2	4.29	3.04
	Yield	0.25	2.3	-0.83	-0.14	-0.09	2.59	2.21
Maize	Area	2.83	2.29	1.13	2.17	2.04	1.32	1.70
	Production	-5.63	7.21	0.28	-3.81	1.56	9.84	2.73
	Yield	-8.22	4.8	-0.84	-5.85	-0.47	8.4	1.02
Jowar	Area	0.22	-2.64	-2.32	-4.64	-13.46	-3.09	-4.18
	Production	3.1	2.84	-5.48	-5.56	-8.98	-2.14	-1.40
	Yield	2.83	5.63	-3.24	-0.97	5.17	0.98	2.90
Total Pulses	Area	-2.15	1.16	3.22	-0.83	-2.23	0.48	1.10
	Production	-4.24	2.06	3.32	-1.93	-2.81	2.36	2.81
	Yield	-2.15	0.88	0.1	-1.1	-0.59	1.87	1.70
Tur	Area	1.09	3.95	10.15	-1.21	-3.98	-0.85	3.02
	Production	-0.2	0.63	10.64	-1.87	-4.8	1.02	4.49
	Yield	-1.28	-3.19	0.45	-0.67	-0.84	1.88	1.42
Gram	Area	-10.4	3.02	0.05	0.64	-2.19	2.77	0.74
	Production	-8.31	6.71	-0.91	1.62	-1.82	5.35	2.50
	Yield	2.34	3.58	-0.96	0.98	0.39	2.51	1.74

Source: Growth rates calculated by authors using log linear method on the data from DoA (2017)

Notes: Period 1:'Pre-green revolution period' (from 1960-61 to 1968-69), Period 2:'Early green revolution period' (from 1968-69 to 1975-76), Period 3:'Wider technology dissemination' (from 1975-76 to 1988-89), Period 4:'Period of diversification' (from 1988-89 to 1995-96), Period 5:'Post-reform period' (from 1995-96 to 2004-05), and Period 6:'Recovery period'

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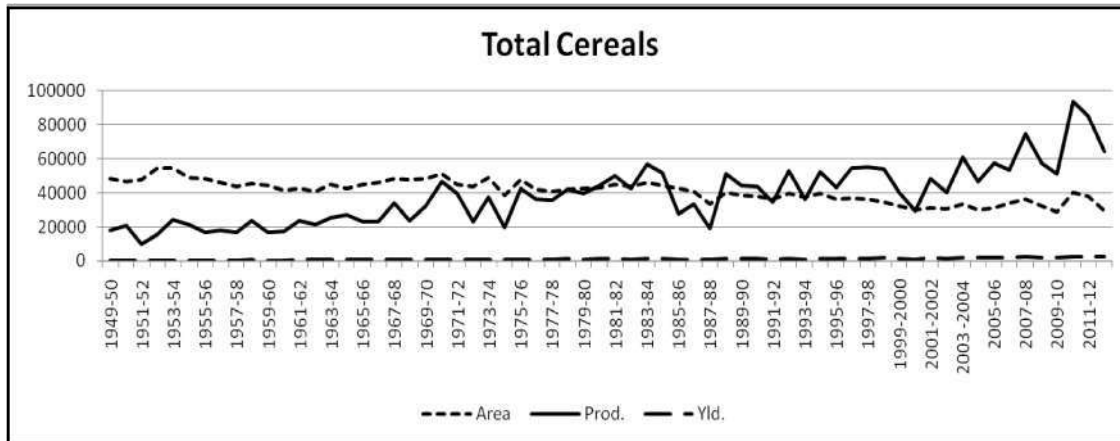
(from 2004-05 to 2012-13). Period 7 represents the growth rates for the entire period from 1949-50 to 2012-13.

As can be observed in table 1, the growth rate for production of food grains was high during the pre-green revolution period (3.39) and was positive during green revolution period up to 1975-76. However, during the period from 1975-76 up to 2004-05 the growth rates of production of food grains remained negative. Nevertheless, a dramatic rise in the growth rate of production of food grains was observed during the recovery period (5.2). In case of the yield of food grains production the growth rates remained positive till the early reforms period and then turned negative during the reforms period. However, during the post reforms period (1.69) and the recovery period (4.16), a positive and high growth rate was observed in the yield of food grains. The growth rate in the area under food grains observed a negative growth rate of 0.47 from 1949-50 to 2012-13. However for the entire period the growth rate of production 2.23 and therefore the growth rate of yield were observed to be 2.71 for all the food grains collectively.

4. Production of cereals in Gujarat

Production of cereals comprised of about 90 percent of total food grains production. Thus, the trends in the area, production, and yield for total cereals in Gujarat followed almost the similar trend as that for total food grains since independence.

Figure 2: Area, production, and yield for total cereals in Gujarat since independence



Source: DoA, 2017

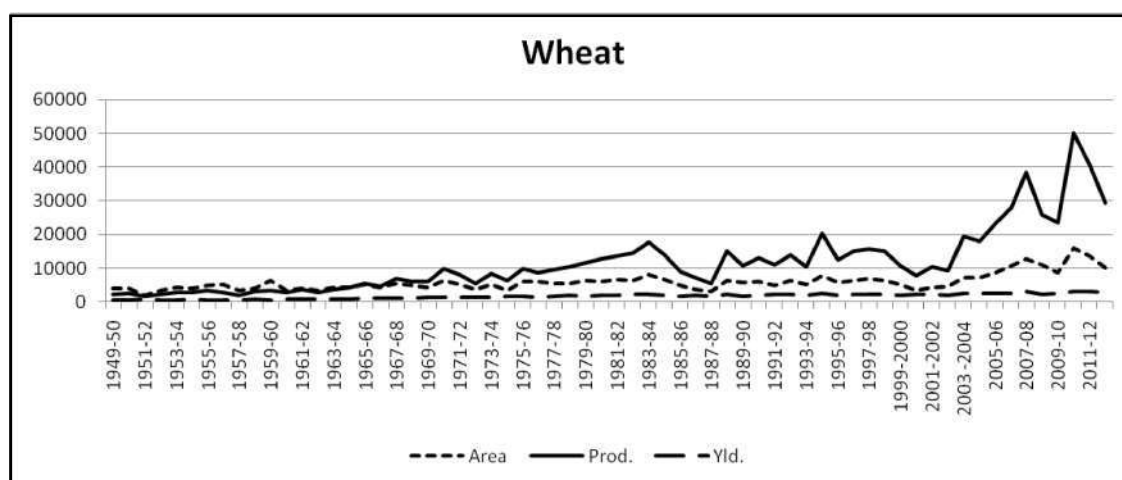
Since independence, the trend in the area under the production of all cereals together observed a downward slope, whereas the trend in the production of all cereals together observed an upward slope as can be seen in Figure 2. Even for the growth rates of area, production, and yield, the trend could be observed to be almost similar to that for the food grains across various periods since independence as can be seen from Table 1. For the entire period from 1949-50 to 2012-13 the area under cereals observed a negative growth rate (-0.72), and the growth rates for production and yield were 2.18 and 2.93, respectively. However, the growth rates for both

production and yield for cereals was higher than the growth rates for production and yield of food grains during the recovery period from 2004-05 to 2012-13 as can be observed in Table 1.

Major cereals produced in Gujarat include rice, wheat, jowar, bajra, maize and ragi. The observations for each of these cereals have been presented further. Historically, wheat production was observed to be the highest amongst the production of majorly produced cereals in Gujarat, followed by bajra and rice interchangeably for different years, and then the production of maize, jowar, and ragi.

Unlike total food grains and total cereals, the trend for the area under the production of wheat was observed to be upward sloping; however the trend for the production of wheat was rather more steeply upward sloping as compared to the trend for the area as can be seen in figure 3. Yield too observed a slight improvement over a period of time since independence. Similar observations were also noted by Gulati, Shah and Shreedhar, 2009; Kumar et al (2010); Mehta (2012) and Chand and Parappurathu, 2012. Area under irrigated wheat was observed to have increased from 0.65 million ha in 2004-05 to 1.18 million ha in 2007-08 (Gulati, Shah and Shreedhar, 2009). The area under the production of wheat (4.47) and its production (11.08) registered a high growth rate even during the pre-green revolution period as seen in Table 1.

Figure 3: Area, production, and yield for wheat in Gujarat since independence



Source: DoA, 2017

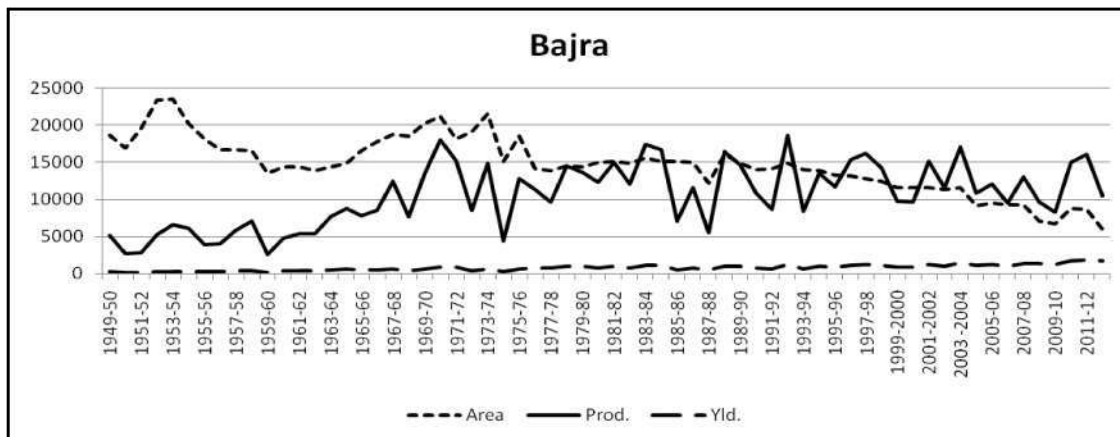
During the early green revolution period until wider technology dissemination period, the growth rate for area under production and the production of wheat reduced and became negative. Nevertheless, during the recovery period both the growth rate for area (5.37) and production of wheat (7.48) observed a high growth rate. Hence for the entire period from 1949-50 to 2012-13 the area (1.39), production (4.07) and yield (2.64) observed a positive growth rate. Particularly the rise in the production of wheat in 80s, 90s and post 2000 contributed in a notable rise in the growth rate of production of wheat. Dramatic rise in wheat production

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post 2000, was also noted by Shah et al (2009). The growth rate of yield was higher during the pre-green revolution period (6.34) that reduced till the entire period of reforms and observed a gradual rise during the post-reforms period (1.09) and the recovery period (2). Similar observations for recent period for wheat have also been made by Gulati, Shah and Shreedhar (2009).

As shown in figure 4 the production of bajra witnessed a lot of fluctuations during the period since independence. While the trend of the area under the production of bajra observed a fall and the trend for the production of bajra observed a rise, fluctuations could be observed. As can be observed from table 1, during the entire four period of early reforms period to post reforms period both the area under production of bajra and the production observed negative growth rates. Basically, the growth rate of area (4.12) and production (9.29) of bajra during the pre-green revolution period could barely be recovered and was far lesser during the recovery period. The growth rate of yield of bajra too largely observed a similar trend, however, the growth rate in the yield of bajra was very high (6.44) during the recovery period. Overall for the period from 1949-50 to 2012-13 the growth rate for area was negative (-1.25) and that for the production and yield was 1.70 and 2.98 respectively.

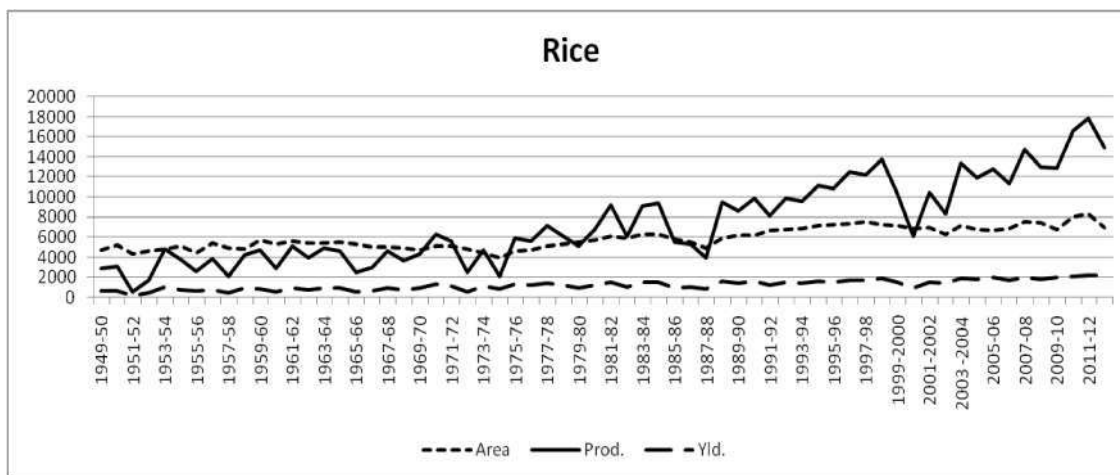
Figure 4: Area, production, and yield for bajra in Gujarat since independence



Source: DoA, 2017

The trend in the area of rice was upward sloping while its production had more steeply rising slope since independence as shown in Figure 5. Trend of the yield too improved moderately. Table 1 depicts that rice was the only cereal that had positive growth rate during the two periods of green revolution-period of wider technology dissemination and period of diversification for both area under production and production. The growth rate of production was high during the recovery period for rice (4.29). In contrast, the growth rate of yield observed fluctuations with negative growth rate during the two periods of green revolution - period of wider technology dissemination and period of diversification as well as the period of post reforms period. In the recovery period though, the growth rate for yield was observed to be high for rice (2.59). Chand and Parappurathu (2012) also observed a high growth rate of above 4 percent for rice in

Figure 5: Area, production, and yield for rice in Gujarat since independence

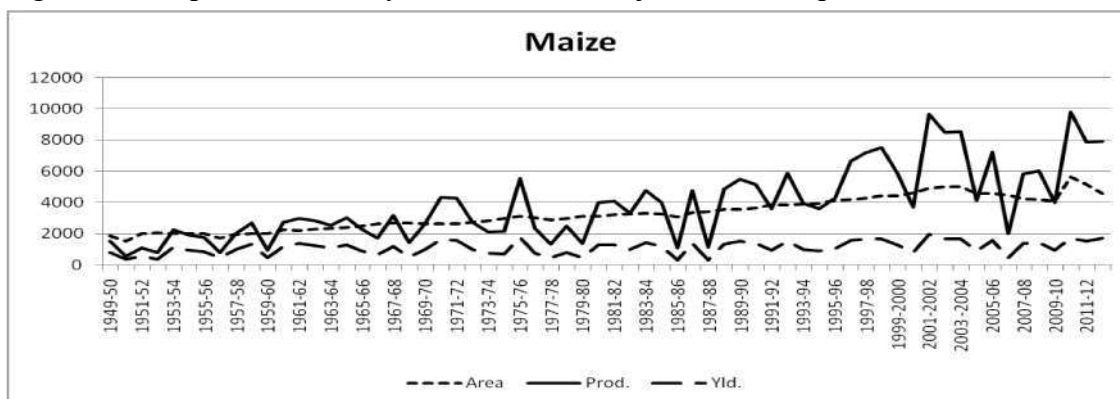


Source: DoA, 2017

2000-01 to 2009-10 in Gujarat. While the growth rates for area, production, and yield for rice from 1949-50 to 2012-13 were positive, but lesser than wheat at 0.8, 3.04, 2.21 respectively.

The trend in the area under the production of maize observed a gradual upward movement. However, the trend in the production and yield of maize observed lot of fluctuations, while the overall trend in the production moved sharply upwards as seen in Figure 6. Table 1 depicts that one of the most noteworthy aspects of the growth rates related to maize was the phenomenally high growth rate for production in the recovery period (9.84), highest among all cereals. Another important observation is that the growth rate for the area under production for maize remained consistently positive across all the periods related to green revolution, which was an exceptional case for maize unlike any other cereal. The growth rate of the yield of maize remained highly fluctuating throughout various periods to finally settle at a high growth rate during the post recovery period (8.4). The growth rate of yield of maize was the highest amongst all cereals during the recovery period.

Figure 6: Area, production, and yield for maize in Gujarat since independence

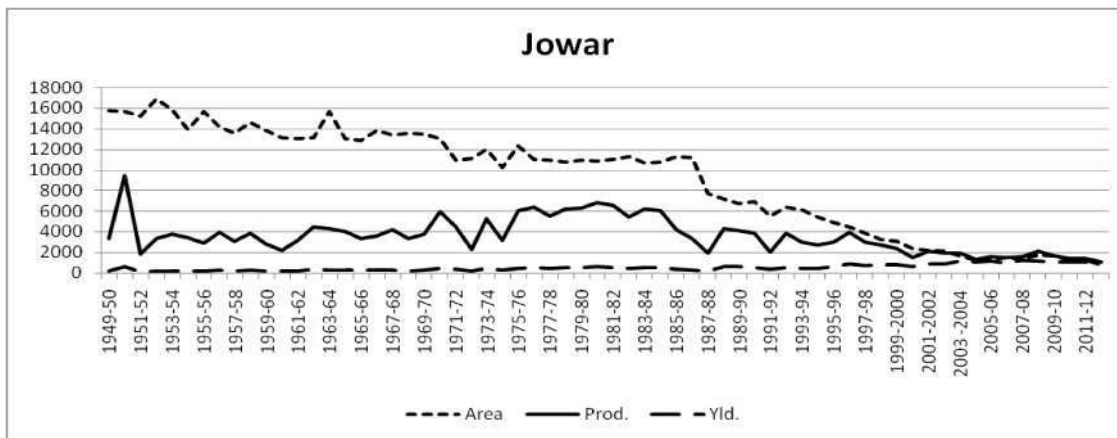


Source: DoA, 2017

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A remarkable observation for the trend in the area under the production of jowar was that it sloped sharply downwards. Amidst fluctuations the trend for the production of jowar too sloped downwards, albeit gradually. However, the trend in the yield moved gradually and nominally upwards as shown in Figure 7. As can be observed in Table 1, throughout the reform period the growth rate for the area under the production for jowar was negative. The growth rate for production of jowar too was negative after the early reform period. However the growth rate of yield for the production of jowar was positive and high during the pre-green revolution period (5.63) and post reform period (5.17). For the period from 1949-50 to 2012-13 the area (-2.18) and production (-1.4) were negative whereas for yield (2.9) it was positive.

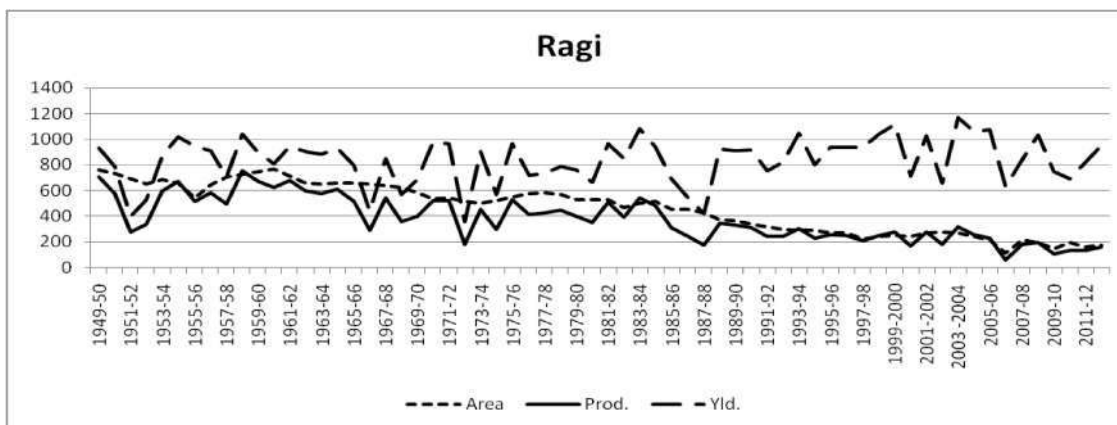
Figure 7: Area, production, and yield for jowar in Gujarat since independence



Source: DoA, 2017

The trend for the area under the production of ragi was observed to be highly fluctuating with an overall constant trend, neither upward nor, downward sloping. The trend for production and yield though fluctuating was observed to be overall downward sloping with a sharp slope. In conclusion, the area under ragi production was large, but in contrast the production and yield was much lower as can be seen from Figure 8.

Figure 8: Area, production, and yield for ragi in Gujarat since independence



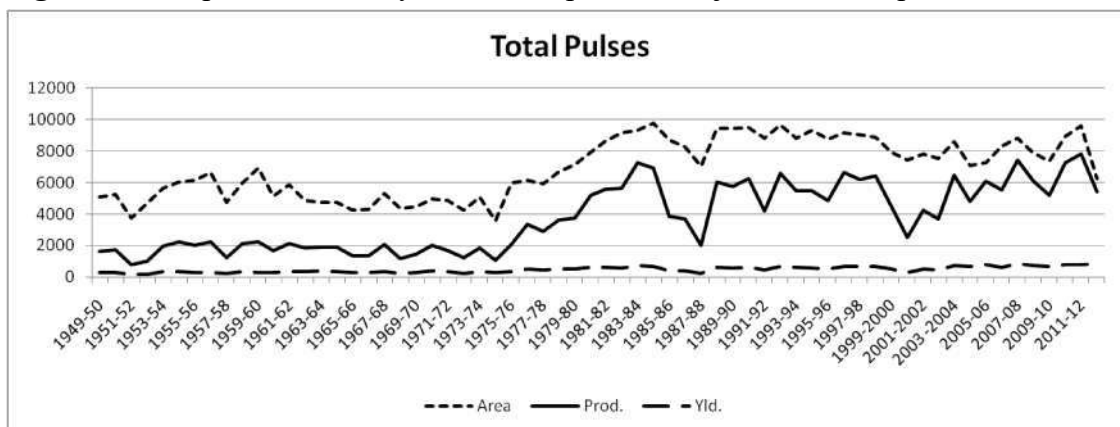
Source: DoA, 2017

Hence the production, area under production and yield for different cereals varied over different periods of agricultural reforms since independence. The growth rates for area (-2.44) and production (-2.21) for the period from 1949-50 to 2012-13 was negative whereas the growth rate of yield (0.26) was moderate. Arya and Mehta (2011) too observed that the yield for wheat rice and maize was higher than the yield of bajra, jowar and ragi, since independence.

5. Production of pulses in India

Pulses constituted of about 10 percent of the food grains production of Gujarat. The trend in the area under production and production of total pulses largely followed a synchronized and similar pattern of crests and troughs, even though an overall upward trend could be observed since independence. The growth rate of yield largely remained stable with meager upward movement since independence as shown in Figure 9. The growth rates for area under production, production and yield for total pulses was negative for 'pre-green revolution period, period of diversification and post reforms period' and remained positive for 'early green revolution period, wider technology dissemination period and during recovery period'. During the recovery period, the growth rate for production was observed to be moderate (2.36) as shown in Table 1. For the entire period from 1949-50 to 2012-13, for all the pulses together, the growth rate for area, production and yield were -0.72, 2.18 and 2.93 respectively. The production of pulses for the period 2000-01 to 2009-10 was termed as promising for the state of Gujarat (Chand and Parappurathu, 2012).

Figure 9: Area, production, and yield for total pulses in Gujarat since independence



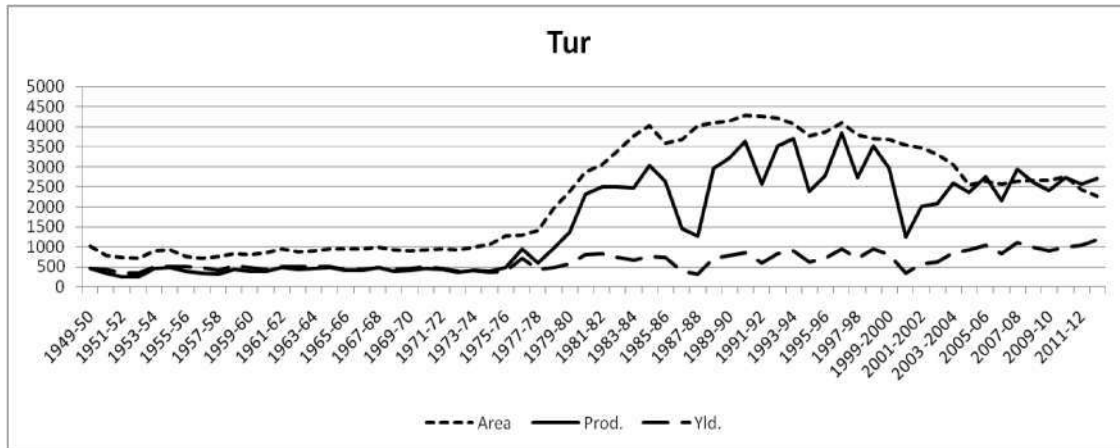
Source: DoA, 2017

Tur and gram are the major pulses produced in Gujarat, but of them the production of tur was observed to be greater for most of the time period since independence. The trend in the area under production and production of tur largely increased during the 1980s, and remained high amidst fluctuations, but resulted in an overall upward sloping trend. The trend of the yield too observed an upward slope as shown in Figure 10. Table 1 similarly depicts that during the period of wider technology dissemination the area under production and production of tur

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registered a high growth rate of above 10 percent. However, during the recovery period the growth rate for area was negative (-0.85) and the growth rate for production was low (1.88). The growth rates for area under production and production under tur for the period 1949-50 to 2012-13 was very high (3.02 and 4.49 respectively) and was 1.42 for the yield.

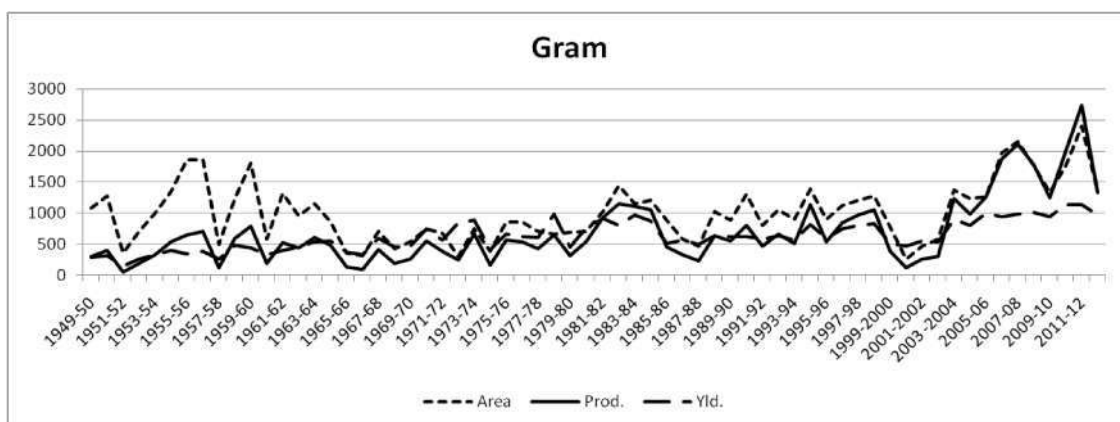
Figure 10: Area, production, and yield for tur in Gujarat since independence



Source: DoA, 2017

The area and production of gram observed fluctuations for most of the time period since independence and during recent years the trend for area, production and yield for gram observed an almost parallel upward sloping trend since independence as shown in Figure 11. Table 1 show that the growth rate for area, and production of gram improved from highly negative during the pre-green revolution period to positive during the early reforms period. During the recovery period the production observed a good growth rate (5.35). The growth rate of yield for gram observed rise and fall across different periods. Amidst fluctuations, the growth rate for area, production and yield for the period between 1949-50 to 2012-13, was 0.74, 2.5 and 1.74 respectively.

Figure 11: Area, production, and yield for gram in Gujarat since independence



Source: DoA, 2017

6. Findings and analysis

Area under production, actual production and yield for different crops behaved differently, across different periods of reforms. While the contribution of a particular production in total agricultural output is vital, efficiency can be better measured using the yield.

Production of wheat observed a sharp upward trend since independence, followed by an upward trend for bajra, rice and maize. Production of jowar observed a moderate downfall, while production of ragi slightly reduced but remained lower than the other cereals. At the end of recovery period, production of wheat was the highest, followed by rice, bajra, maize, jowar and ragi. Production of gram and tur both observed an upward trend since independence; however the rise in tur was steeply upward sloping. The production of tur and gram was higher than the production of jowar and ragi at the end of the recovery period but was much lower than other coarse cereals. It is worrisome since the pulses are important sources of proteins and policy directives to emphasize pulses productions have been suggested (Shah, 2011). However higher fluctuations were observed since 80s and particularly the years with major decline were seemingly attributed to weather conditions and rainfall (Arya and Mehta, 2011).

In terms of area under production, the highest growth rate since independence was observed for maize (1.7), and then by wheat (1.39) followed by rice (0.8). However, the area under production for jowar (-4.18), ragi (-2.44) and bajra (-1.25) plunged maximum since independence. The area under production for wheat almost remained higher than other food grains and that for ragi almost remained at lower levels since independence. At the end of the recovery period, wheat covered the highest area among cereals in Gujarat, followed by rice, bajra, maize, jowar, and ragi. Likewise, in case of pulses the area covered by both gram and tur observed a rise since independence however the rise in tur was steeply upward sloping. The area covered under the production of gram and tur was more than the area covered under the production of jowar and ragi at the end of the recovery period. These findings are similar to those made by Mehta (2012) and Pattnaik and Shah (2013, 2015) for recent period. Discussions related to area under production should consider that Gujarat has been characterized with small operational land holdings (Mehta, 2012), thereby negatively affecting the land efficiency.

Hence, comparing the area under production with the production for each cereal, it can be observed that largely the area under production of wheat and production of wheat almost followed a parallel trend. Similar trend was also observed by Gulati, Shah and Shreedhar (2009) for wheat for the period from 1996-97 to 2007-08. However, jowar and bajra occupied much greater area under production, more than the area occupied for the production of wheat until 1990s and 2000s respectively. But, the production of bajra was moderately higher than the production of wheat till 1983-84, almost at par with wheat till 2003-04 and lesser than wheat after 2003-04. Likewise, the production of jowar was moderately higher than the production of wheat till 1963-64 and then consistently lesser than the production of wheat. Fall in the area under production of jowar and bajra was also noted by Mathur and Kashyap (2000). While the production of rice and maize fluctuated more the area under production for rice and the production

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of rice almost followed a parallel trend, with rise in both observed to be almost parallel and trending upwards. While the area under production and production for ragi observed a downward trend, it remained lowest compared to other cereals. Wheat (4.07), rice (3.04), maize (2.73) and bajra (1.7) observed a positive growth rate in production however jowar (-1.4) and ragi (-2.21) observed a negative growth rate in production since independence.

Yield for all the cereals and pulses observed an upward trend. However, since independence the growth rate for yield was the highest for bajra (2.98) followed by jowar (2.9), wheat (2.64), rice (2.21), maize (1.02) and ragi (0.26). Yield for ragi almost remained low but was lower than bajra after 1985-86 and lower than jowar after 2003-04. Table 1 and various figures substantiate the argument by Pattnaik and Shah (2012) that higher yield is accompanied by higher instability as was the case with bajra, maize, rice and gram. Higher yield in wheat, rice and bajra was suggested to be resulting in large production (Mathur and Kashyap, 2000). However, if farmers would not be sufficiently incentivized for the production of food grains, then as observed and suggested by Mathur and Kashyap (2000), Dixit (2009), Shah, 2011, Mehta (2012) and noted by Shah et al (2009) area under production of food grains might observe a shift from food grains production to non-food grains production.

Conclusion

Food grains production in Gujarat has undergone many changes since independence. At the onset of green revolution and during its aftermath different crops observed different impact on their area under production, total production and yield. While production and area under production of wheat registered a positive impact, the yield of wheat also observed the highest growth since independence amongst food grains. Particularly after 2003-04 the rise in all the three indicators of wheat was exceptional. Area under production of bajra and jowar, which were high immediately after independence, seem to have gradually gone to the area under production of various non-food grain crops. The yield for wheat, rice, and maize was higher than the yield of bajra, jowar, and ragi, for the period since independence. Amongst pulses, both area under production and production for tur observed a sharp rise particularly since 1977-78.

The trends in the prices of these food grains play an important role in influencing farmer's choices of what and how much to produce. Equally crucial is the impact of prices of other crops that can alternately be produced like Bt. cotton. The input costs involved, topographical conditions, marketing conditions, government incentives like Minimum Support Prices (MSP), rainfall and irrigation facilities, natural calamities, technological up gradations, education of farmers, infrastructural development like power and roads, etc. are certainly detrimental to the choice of food grains production and output. While high yield may indicate the most efficient production vis-à-vis land availability, but the actual production is more likely to be determined by the demand and market conditions for a particular food grain. However, a comparison with other states for food grain production and a comparison of other crops and food grains within the state can provide more explicit comparative analysis of whether Gujarat enjoys comparative cost advantage in the production of food grains or not. Solely observing the state of Gujarat, the food grains with

higher production also registered higher yield. Hence, it can be concluded that whatever food grains are being produced in Gujarat are largely utilizing land efficiently, given the higher yield too for those food grains. Farmers and policy makers may although put more efforts in increasing the yield for cereals like bajra, jowar and ragi and pulses like gram, to get more output per hectare of land. Reasons for low yield of these cereals and pulses should be identified and attempts should be made to improve their yield. Alternately, these food grains would be replaced by other food grains or non-food grain crops like spices, fruits, vegetables or oil seeds like groundnut, tobacco and cotton with the passage of time. Farmers respond to incentives, either given by the market or the government. So largely the customer's demand and government priority backed incentives can nudge the farmers to produce certain food grains in certain quantity.

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Implementation of MGNREGS in Gujarat: A Study with Special Reference to Women Labourers

Parimalsinh Chavda¹ and Sonal Bhatt²

Abstract

This paper attempts to examine the status of women who work in MGNREGS vis-à-those women who work in places other than MGNREGS with respect to their working conditions; facilities at the work site; wage earnings as well as position and respect enjoyed by them in their own families. It concludes that the women working in MGNREGS fare better in terms of facilities provided on the work-site. However, their mean wages are lower compared to that of the women who choose avenues of work other than MGNREGS. Also, the status of women in terms of their position in the family and the weightage of their opinions in important decisions of the family does not differ much. However, the women MGNREGS workers have a much greater control over their choice of either accumulating or spending their earnings in the way they choose.

Introduction

The MGNREGS aims to increase the employment opportunities for rural people who face seasonal unemployment during the lean agricultural season. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) was passed in 2006, as a flagship welfare programme of Government of India, aimed at alleviating rural poverty and distress through providing employment to the rural poor. It was initially implemented in two hundred most backward districts of India; Subsequently, the MGNREGS was extended all over India in two more stages, i.e. additional 130 districts in 2007-08 and all the remaining districts from 2007-08 onwards.

It is noteworthy that MGNREGA is not an endowment-based legislation, but a rights-based one. It also aims to empower socially and economically disadvantaged sections of the rural population, viz. women, Scheduled Castes (SCs) and Schedules Tribes (STs). The works selected to be undertaken under this scheme are supposed to be labour-intensive; and not capital-intensive. Besides, at least one-third of the labour employed under MGNREGS must be women. Another important rule is that the MGNREGS forbids the engagement of commercial middlemen like contractors or other labour-displacing machinery during the execution of the works. This has a substantial bearing upon the possibility of exploitation of the rural masses at the hands of such predatory social agents. Many studies have been undertaken so far, on the implementation and impact of MGNREGS on rural life and economy as well as its impact on the earnings, working conditions and social status of women labourers who choose to work in MGNREGS works.

¹ Research Scholar

² Corresponding Author and Research Supervisor

A Review of Literature

MGNREGS is touted as a powerful policy intervention for the empowerment of rural women (Sabana, 2016) through its strategy of providing livelihood security, democratic governance and social protections (Kaushal and Singh, 2016) which are of great importance to the disadvantaged sections of rural workers, particularly women workers. It has addressed a number of practical needs of women labourers (Jena, 2012) such as eliminating the wage gap amongst male and female workers for doing the same type of work (Chandrashekar and Ghosh, 2011) and providing work in the proximity of home in a safe environment (Farooqi and Saleem, 2015). Women workers have expressed satisfaction with the working conditions of MGNREGS (Kant and Ashvine, 2013) as they felt more comfortable (Selvamani, 2012) and happy to find work in their own village itself (Jacob, 2008). Monika (2017) and Akhtar and Imran (2015) have highlighted the lack of basic facilities such as crèches for children of women workers at the work-sites. The pay for women labourers in MGNREGS is higher than that in other unorganized sector jobs and therefore is more attractive to them; as they now enjoy a better bargaining power with respect to their wages also (Mullappally Kayamkulath and Ahammed, 2014). In some states women shared more than ten percent of the wage incomes distributed under MGNREGS (Sudha and Das, 2014). The overall impact of MGNREGS on women was found to be quite positive as it promoted their economic independence (Agrawal and Devi, 2015), standard of living (Xavier and Mari, 2014), employment (Kar, 2013) and self-confidence, as well as communication and mobility (Kiruthika, 2017); thus helping them to repay their debt (Shobha, 2015) and have larger role in decision-making in the household. Women workers in MGNREGS reported an increased confidence in playing their traditional roles in the family; as now they were able to also contribute towards the family expenditure (Ananta, 2016), have a say in family decisions and also spend some money on their personal needs (Nath, 2016; Tripathi, 2013). They paid particular attention to saving their income by way of the compulsorily opened bank accounts in their own names as a practice under MGNREGS (Karthika, 2015). Their dependence on their husbands decreased (Babu and Sudhakar, 2014). Women learnt the method of banking transactions, mingling with outsiders, became more socially and politically aware (Ambily, 2016). In this way, it has played an important role in the social and economic empowerment of women beneficiaries in particular (Rajlaxmi, 2017) and laid the foundation of independence and greater self-esteem amongst these women (Sanyal, 2017). Ahangar (2014) made a very interesting observation regarding the impact of MGNREGS on the status of widows. He noted that widows working in MGNREGS got more self-respect than before and were able to mingle with others, share their feelings and participate more freely in the Gram sabha. As the MGNREGS wages are paid directly to the beneficiaries through bank transfers; it encourages savings amongst women workers (Poonia, 2012).

Not all studies bring out a positive impact of MGNREGS on the status of women. Nayak, (2013) found various bottle-necks such as lack of awareness about provisions of MGNREGS amongst the beneficiaries; lack of crèche facilities at worksites for mothers having very young children; lack of women's ownership of job cards and bank accounts; wage

discrimination between men and women, harassment at the work site. Sharma (2012) reported a lack of appropriate gender-friendly methods of information dissemination and also an absence of basic facilities such as drinking water and toilets at the work sites, which discouraged women from working in MGNREGS.

Objectives of the Study

In this paper, an attempt has been made to examine the status of women MGNREGS labourers vis-à-vis women labourers who worked in places other than MGNREGS with respect to their working conditions; facilities at the work site; wage earnings as well as position and respect enjoyed by them in their own families.

Selection of Sample

This study was conducted in two districts of Gujarat namely Anand and Panchmahals. The selection of the districts was done purposively; as Anand is a prominent district in central Gujarat with a progressive and well-developed agricultural sector; whereas Panchmahals is a backward district is the eastern tribal belt of Gujarat with a backward agricultural sector and a majority of tribal population. Besides, Anand is considered as semi-urban district while Panchmahals is considered a rural district (GoI, 2011).

Further, two villages each were selected purposively from both Anand and Panchmahals in such a way that the MGNREGS works were currently in progress in those villages. This makes four villages for the study namely Kasor and Meghalpur from Anand district and Mor dungara and Sarangpur from Panchmahals district.

The selection of MWL (MGNREGS Women Labourers) included in the sample was done by purposive sampling method from amongst the women who were found to be working on the MGNREGS work site at the time of the field visit. The selection of NMWL (Non-MGNREGS Women Labourers) was also done purposively from the same village; from amongst women who possessed the Job Card issued under MGNREGS but did not work in MGNREGS schemes. Instead, they chose to work in various other jobs such as small eateries, construction sites as well as in households as maids. The selected sampling framework is presented in Table 1 as follows:

Table 1: Selection of Sample Respondents

District	Village	MGNREGS Women Labourers (MWL)	Non-MGNREGS Women Labourers (NMWL)	Total
Anand	Kasor	10	10	20
	Meghalpur	10	10	20
Panchmahals	Mor dungara	10	10	20
	Sarangpur	10	10	20
Total		40	40	80

Source: Primary survey conducted by researcher

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Data Collection

The present study is based on primary and secondary data. The secondary data required for the study was collected from the official website of MGNREGS as well as research reports and publications of the Government of India, Census of India Handbooks, National Sample Survey Organization, Government of Gujarat, District Panchayat and Taluka Panchayat publications. Besides, research papers in journals and periodicals available offline and online were also referred to.

The primary data for the study was collected with the help of a structured questionnaire which was administered on both the i) MWL and ii) NMWL. The field survey for this study was conducted in March-May 2016.

Results and Discussion

The results of the study are presented as follows:

(A) Participation of Women Labourers in MGNREGS works

This section gives an overview of the participation of women labourers in MGNREGS works during the years 2006-07 to 2016-17 as shown in Table 2 and also depicted with the help of Fig 1 as follows:

Table 2: Total Person-days and participation of Women in India and in Gujarat state under MGNREGS

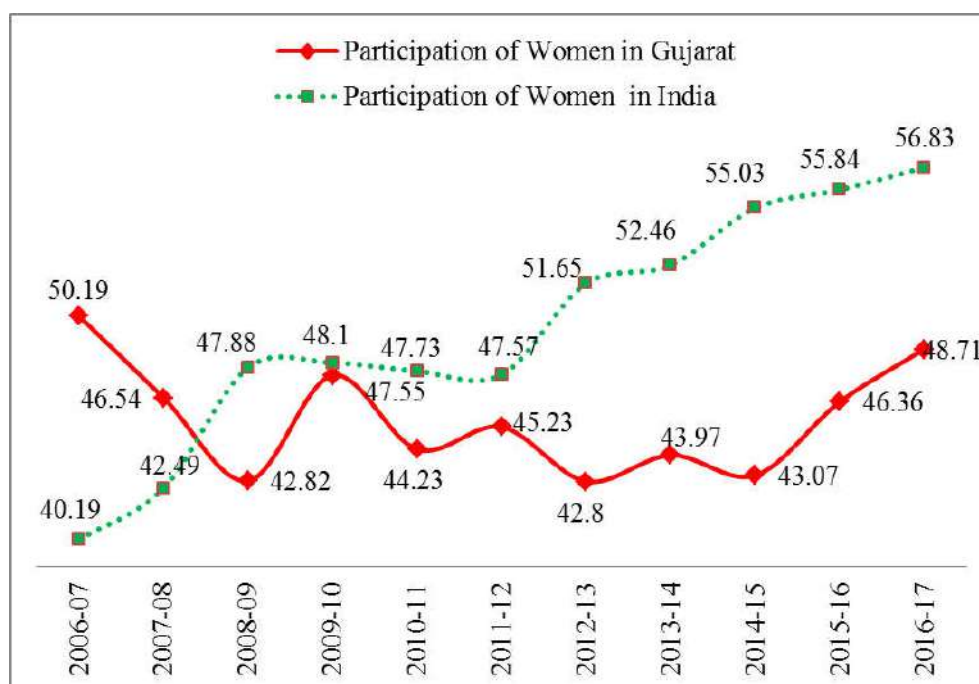
(FY 2006-07 to FY 2016-17)

Years	India		Gujarat	
	Total No Person- days (in lakhs)	% Women Participants	Total No Person- days (in lakhs)	% Women Participants
2006-07	9050.56	40.19	100.48	50.19
2007-08	14376.14	42.49	90.06	46.54
2008-09	21632.86	47.88	213.07	42.82
2009-10	28359.59	48.10	585.1	47.55
2010-11	25715.23	47.73	491.84	44.23
2011-12	20156.86	47.57	311.21	45.23
2012-13	20547.19	51.65	280.07	42.80
2013-14	20750.35	52.46	230.25	43.97
2014-15	14897.78	55.03	172.01	43.07
2015-16	17646.59	55.84	146.79	46.36
2016-17	1932.69	56.83	25.23	48.71
Mean for this period	17733.26	49.62	240.56	45.59
Standard Deviation	7477.28	5.34	170.70	2.50

Source: <http://www.nrega.nic.in/netnrega/home.aspx> retrieved on May 4, 2018

The Table 1 shows total persons-days generated under MGNREGS and participation of women in the same in India as a whole as well as the state of Gujarat. The ratio of participation of women is observed to be higher in India than in Gujarat, as the mean percentage of women's participation is higher in India as a whole during the decadal period, than it is in the state of Gujarat during the same period. However, the descriptive statistic namely the higher Standard Deviation from the mean for India and Gujarat in these series shows that while the proportion of women's participation is higher on an average in India than in Gujarat, the consistency of participation of women is greater in case of Gujarat, reflected in a lower Standard Deviation from the mean. In both the case however, it is heartening to note that the participation of women labourers is well above the condition of the minimum limit of which mandates that at least one-third of the employment generated should be given to women.

Figure 1: Participation of Women in MGNREGS in India and Gujarat State (FY 2006-07 to FY 2016-17, figures in per cent)



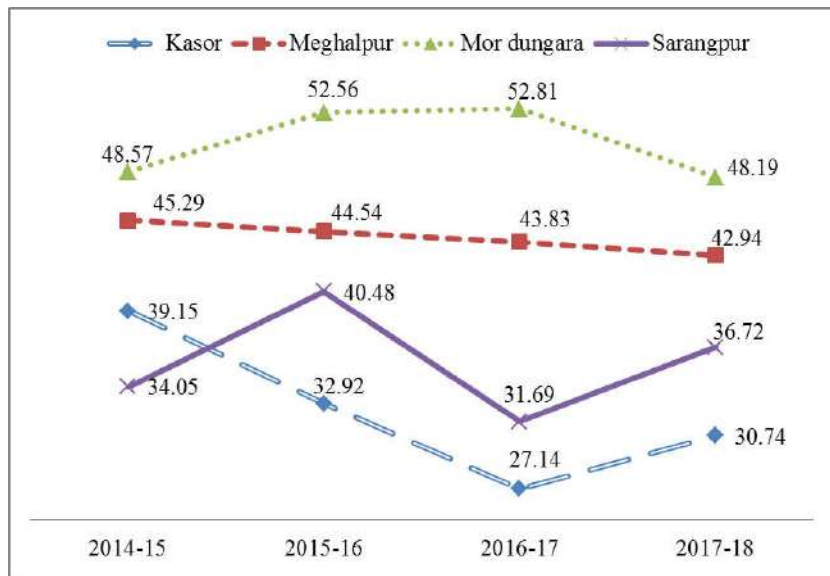
Source: Compiled from the data available on http://www.nrega.nic.in/netnrega_home.aspx accessed on May 4, 2018

It is further revealed by Figure 1 that the share of women in total person-days of employment generated under MGNREGS both in India and in Gujarat state in the period from FY 2006-07 to FY 2016-17 is showing an increasing trend.

The researchers tried to investigate whether the same trend is seen with respect to the villages under study. As depicted in Figure 2, the share of women labourers in MGNREGS in the villages under study, namely Kasor, Meghalpur, Mor dungara and Sarangpur during the

years FY 2014-15 to FY 2017-18, for which village-level data was available, showed a slightly different trend.

**Figure 2: Participation of Women in Sample Villages
(Figure in per cent)**



Source: Compiled from the data available on http://mnregaweb4.nic.in/netnrega/all_lvl_details_dashboard_new.aspx accessed on May 12, 2018

It could be observed from Figure 1 that the ratio of participation of women labourers was nearly fifty per cent in Mor dungara, whereas it was close to forty five per cent in the village of Meghalpur. Thus, this is quite in keeping with the national and state-level trends.

However, the trend with regard to women's participation was quite uneven in Sarangpur village of Panchmahals district where it fluctuated between thirty and forty per cent in the years for which the data is presented. Similarly, in the village of Kasor in Anand district, the participation of women dipped greatly to touch the lowest level of 27.14 per cent in 2016-17. Thus, Kasor could be seen as the only village among the study villages where the participation of women labourers has not met the provisions mentioned in the MGNREGS guidelines. Moreover, in both Kasor and Sarangpur, the share of women in the total employment created also shows great fluctuations year on a year-to-year basis.

However, it is encouraging to note that Mor dungara in Panchmahals and Meghalpur in Anand district, there were good opportunities for women to work in their hometown under MGNREGS.

(B) Physical Facilities Available to Women Labourers in MGNREGS works

According to MGNREGS Guidelines, facilities such as first aid, drinking water and

shaded seating arrangement are to be provided on the work site by MGNREGS local implementing authorities. If the number of children under the age of six years belonging to women labourers is more than five, a crèche equipped with a caretaker is also to be provided on the work site by the local authorities. Also, work has to be given within 5 kilometers from the place of residence of the workers. If the distance of worksites is more than 5 kilometers then they have to be paid an extra 10 per cent of the wage rate for meeting transportation costs. Women labourers must be paid wages equal to male labourers. This researcher tried to find out whether the promised facilities were indeed being provided to WMLs on the work sites.

Table 3: Physical facilities on Worksites for Women Labourers in MGNREGS

Characteristics	Responses	Number of Respondents
Distance of work site from residence	Less than 5 km.	80 (100)
	More than 5 km.	00 (-)
	Total	80 (100)
Drinking water facilities	Available	80 (100)
	Not Available	00 (-)
	Total	80 (100)
First Aid facility	Available	80 (100)
	Not Available	00 (-)
	Total	80 (100)
Crèche facility	Available	00 (-)
	Not Available	80 (100)
	Total	80 (100)
Shaded seating facility	Yes	80 (100)
	No	00 (-)

Source: Primary survey conducted by researchers as well as field observations

Note: Figures in parenthesis are percentages

As shown in Table 3, the WML in the sample reported that the distance of worksite from their home was less than 5-kilometer area and hence, none of them had felt any need to demand extra wages. The data as well as the field observations of the researcher also revealed that on all work sites of MGNREGS in the selected villages, facilities such as drinking water, first aid and shaded seating arrangement were available. However, the facility of a crèche meant for young children of the women labourers was not found to be available on any of the work sites of MGNREGS in the study villages. The researchers noticed about two to three children during the field visit who were aged below six years. They were found to be accompanying their mothers on the work site but no provision was made for their caretaking or education.

(C)Wage Rates of Women Labourers

A comparison of wage rates earned by MWL and NMWL was done by the using paired sample test as follows:

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H_0 : There is no significant difference in mean value of daily wage rate earned by MWL and NMWL

H_1 : There is a significant difference in mean value of daily wage rate earned by MWL and NMWL

Table 4: Analysis of Comparison of wage rates of Women Labourers

Paired Samples Statistics					
Variables		Sample Mean	N	Std. Deviation of Sample Mean	Std. Error of Sample Mean
Pair 1	Wage rate of NMWL	174.00	40	9.554	1.511
	Wage rate of MWL	167.00	40	0.000*	0.000*

(*Note: Std. deviation of sample mean is 0.000 because the wage rate of MWL is uniform for all workers)

Paired Samples Test									
Comparison		Paired Differences				t	df	P	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	Wage rate of NMWL minus Wage rate of MWL	7.000	9.554	1.511	3.944	10.056	4.634	39	0.000*

Note: * at 5 % level of significance

t = Calculated value of t-statistics; p= Probability value (Two tailed); df= Degree of freedom

It could be seen from Table 4 that the mean wage rate of WML in the selected sample of respondents was Rs. 167 while the mean wage rate of NMWL was Rs. 174. The results of the paired-test show that the t-value is 4.634 and its p value is significant at 5 per cent level of significance. Hence, the null hypothesis is rejected. This indicates that there is significant difference between the mean value of wage rates paid to MWL and NMWL. The women labourers working in places other than MGNREFGS works earn a higher daily wage rate on an average than those women who are MGNREGS labourers.

(D) Socio-economic Status of Women Labourers

Table 4 presents the changes that were experienced by MWL vis-a vis NMWL. It show the responses of women in the sample villages with regard to their role in their family circle as well as their individual economic strength.

Table 5: Comparison of Responses Related to Socio-economic Status of Women Labourers

Particular	MWL	NMWL
Increased Contribution in Household Income	40 (100)	40 (100)
Ability to Take Decisions Concerning Oneself on One's Own	8 (20.00)	10 (25.00)
Ability to Take Decisions Regarding Education of One's Children	7 (17.50)	6 (15.00)
Have a Say in Decisions Regarding Marriage of One's Children	2 (5.00)	4 (10.00)
Possess Own Savings	35 (87.50)	16 (40.00)
Purchase Personal Assets (Ornaments or Jewelry)	26 (65.00)	11 (27.50)
Improves Social Status due to being Employed	16 (40.00)	20 (50.00)
Feel Self-confident	12 (30.00)	24 (60.00)

Source: Primary survey conducted by researchers

Note: Figures in parenthesis are percentages

The data collected from the field survey shows that 100 per cent of the MWL reported that after joining MGNREGS, their earnings helped to increase their family income. Total 80 per cent MWL respondents reported that after joining MGNREGS there was no change in their role towards decision-making in matters concerning themselves and that they were still required to take permission from their husbands or other family members for anything that they wished to do. Moreover, 82.5 per cent MWL reported that they had no say in decisions regarding their children's education. Only 2 (5 per cent) WML reported that after joining MGNREGS their family had started giving due weightage to their opinion regarding the decisions concerning important personal matters such as their children's marriage. Total 35 (88 per cent) MWL reported that with the help of MGNREGS income, they were able to accumulate their own savings while 26 (65 per cent) MWL reported that after joining MGNREGS they purchased few ornaments (jewelry) for their personal use. An improvement in social status of women was felt by 16 (40 per cent) MWL while 12 (30 per cent) MWL felt that working in MGNREGS was helpful to improve their self-confidence. Thus, a tangible advantage for MWL came in the form of an increased family income as well as an opportunity to accumulate savings in secured form in their personal bank accounts. A part of the accumulated savings was also reported to be used for expenditure of a purely personal nature by the MWL. However, their position in the family hierarchy and decision-making structure had not improved much.

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As far as NMWL are concerned, while all the NMWL sample respondents reported that their earnings helped in increasing their family income; only 25 per cent of them said that they could take decisions concerning themselves on their own, without requiring to take approval from anyone else. Similarly, only about 15 per cent of NMWL reported that they had a say in their children's educational choices, whereas only 10 per cent of them reported that they took part in decisions regarding their children's marriage. In spite of being fruitfully employed, only 40 per cent of NMWL had accumulated savings in a bank account in their own name. Similarly, only 27.5 of NMWL had purchased personal items such as jewelry from their own earnings.

It emerges from the above data, that while the status of women in their family hierarchy has remained more or less the same, whether or not they work in MGNREGS; a noticeable difference can be observed with regard to their personal economic well-being. Since MWL are paid through bank in their own names and in their own accounts, it is difficult for relatives to snatch away the women's income. Hence, their personal savings and personal expenditure has shown an increase. On the other hand, the NMWL, even though earning on their own, may not be able to safeguard and accumulate their earnings. Hence, their personal economic status, still remains fragile.

Conclusion

It could be concluded from the results of the above study that whereas the women working in MGNREGS in Anand and Panchmahals fare better in terms of facilities provided on the work-site; their mean wages are lower compared to that of the women who choose avenues of work other than MGNREGS. Also, the status of women in terms of their position in the family and the weightage of their opinions in important decisions of the family does not differ much, whether they are working in MGNREGS schemes or at other places. However, the women MGNREGS workers receive their earnings directly in the form of payments in their personal bank accounts. This gives them a much greater control over the choice of either accumulating or spending this amount in the way that they choose. Thus if women's empowerment is a slow and gradual process, MGNREGS is but a small step towards this goal.

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Clustering Based Operational Expenditure Model for Solar Generation: A Solution to the Revenue Losses Problem of Punjab State Power Corporation Ltd. (PSPCL)

Gur Gaurav Singh¹ and Shaveta Kohli²

Abstract

Rooftop based grid tied solar generation by individual consumers is inimical to the interest of power distribution companies (DISCOMs), as this rooftop solar generation causes financial loss to DISCOMs in terms of loss of energy sale. Hence DISCOMs actively dissuade this form of distributed solar generation by various means. It is of paramount importance to make a balance between renewable energy generation goals and the revenue generation of DISCOMs. DISCOMs need to be financially strong to ensure adequate power supply in case of energy shortfall in any case. This paper sets out a solution to this paradox, in terms of an alternative business model, in which DISCOMs will install solar panels on physically connected rooftops of different consumers and thus form a generation cluster. In this clustering based operational expenditure (OPEX) model, consumer will get benefit for providing the rooftop for solar power generation thus lowering the energy bill cost. On other hand DISCOM will get its own generation and there will be no loss of energy sale and it will be a win-win situation for both.

Keywords- Clustering; Distribution Company (DISCOM); Operational Expenditure (OPEX); Rooftop; Solar.

Introduction

The solar energy generation has received a major push around the world with increasing concern for environment, which has led to steep drop in prices of solar energy related equipment. The solar generation unit installed on rooftop of buildings is generally used for supplying some proportion of power requirement of the individual consumer on whose rooftop it is installed. Thus consumer draws lesser power from DISCOM grid, resulting in lower energy sale for DISCOM. This lower energy causes loss of revenue for DISCOM. In emerging economies, especially in India, DISCOMs are marred by high T&D losses, mounting debts and weak infrastructure. Any loss of business would critically hamper their capabilities further. There is growing trend of giving power subsidies to certain segments of society e.g. farmers, socially backward classes, etc. particularly in the Punjab state. The cost of which is offset by means of cross subsidy burden on other well off consumers or by means of increasing general tariff. With the passage of time, because of scarcity of natural resources, the cost of fossil fuels is increasing, which is resulting in higher cost of generation. Fossil fuels based thermal power plants comprises

¹ Assistant Engineer, PSPCL, Punjab-144001

² Assistant Professor, Department of Economics, Central University of Jammu, Samba (J&K)-181143

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largest share of generation compared to other sources of power generation in India. Thus increasing cost of electricity will push energy intensive consumers to take up rooftop based Solar Photo Voltaic (SPV) generation to lower their energy bill, which is major loss for DISCOMs, as these energy intensive consumers bear the major cost of cross subsidy. To compensate this loss of revenue and cross subsidy burden of DISCOMs, electricity tariff will have to be increased, which will further make rooftop based solar generation more lucrative for energy intensive consumers (CCEW, 2018).

In India, under Jawahar Lal Nehru National Solar Mission (JLNNSM) the target set for renewable energy generation by harnessing solar power is 100 GW by 2022, out of this 40 GW is to be achieved through grid tied rooftop Solar Photo Voltaic installation at consumer premises (MNRE, 2012). But for unforeseen circumstances, no storage capacity has been provided in this system and as soon as grid supply goes out due to power cut or fault in feeder, Solar Photo Voltaic generation unit also gets disconnected from grid. Though batteries could be provided to store energy, but by avoiding these, capital cost and maintenance cost of batteries is avoided.

To analyze net loss of energy sale of DISCOMs in India due to JLNNSM, we will look at major solar capability states to comprehend the effect, as shown in table 1. The financial loss is calculated assuming per unit rate of 9 INR /Unit by year 2022

Table 1. Expected Loss of Energy Sale

S.No	State	Rooftop SPV Target (MW) as per JNNSM*	Approx. Annual generation KWhr/KWp ¹	Loss of energy sale (Million Units)	Expected Financial Loss Due to Lesser Energy Sale (Crores INR)
1	U.P	4278.8	1380	5904.74	5314.03
2	Rajasthan	2304.8	1500	3457.20	3111.48
3	Punjab	1908.8	1380	2634.14	2370.73
4	M.P	2270	1500	3405	3064.5
5	Maharashtra	4770.4	1500	7155.6	6440.04
6	A.P	3933.6	1500	5900.4	5310.36
7	T.N	3553.6	1500	5330.4	4797.36
8	Karnatka	2278.8	1500	3418.2	3076.3
9	West Bengal	2134.4	1380	2945.47	2650.9
10	Gujarat	3208	1500	4812	4330.8

Source: Ministry of New & Renewable Energy, 2018

¹ This has been assumed considering the previous and the present electricity tariff rates in Punjab www.pserc.com

² Kilo Watt Peak (Installed Solar Generation Capacity)

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If 40 GW of rooftop based solar generation capacity is installed till target year of 2022 under JNNSM and annual generation is taken around 1400 KWhr/KWp (estimates based on Solar Calculator MNRE), then overall loss of energy sale for all DISCOMs would be 56000 Million Units (MU) which would cause approximate 50,000 Crore INR loss annually. This clearly indicates significant loss of energy sale if target capacity of 40 GW is achieved, which would lead to reduction in Capital Expenditure (CAPEX) capability of DISCOMs, which will critically weaken grid infrastructure. Data reveals that the distribution to industrial and agricultural sector has reduced with the passage of time but the burden of agricultural subsidy on DISCOMS is much higher as compared to the revenue generation from this section. In the year 2013-14 it has shown a negative figure i.e. -0.79. Table 2 shows energy sale and revenue sale of power of PSPCL, which is as follows:

Table 2: Energy sale (MUs) by PSPCL in Different Sectors and Revenue Generation

Sr. No.	Description	2009-10	2010-11	2011-12	2012-13	2013-14
1	General	28.96	31.94	33.27	33.56	36.19
2	Industrial	35.08	34.22	34	33.92	33.58
3	Agricultural	33.54	31.38	30.33	30.16	27.79
4	Others	2.42	2.46	2.4	2.36	2.44
Revenue from Sale of Power (In Crores)						
Sr. No.	Description	2009-10	2010-11	2011-12	2012-13	2013-14
1	General	3147.647	3862.63	4460.959	5250.58	6560.78
2	Industrial	4728.595	4682.721	5147.368	6452.56	8010.6
3	Agricultural	-0.3	520.61	1.63	3.08	-0.79
4	Others	812.721	598.794	587.987	618.01	773.72
	Total	8688.933	9664.751	10197.94	12324.23	15344.31

Source: PSPCL, 2018

Due to fluctuating and unreliable nature of solar energy, DISCOMs would still have to ensure reserve power capacity to meet any shortfall of supply in event of low solar generation. Due to this sudden shortfall in supply, DISCOMs even might bear deviation charges due to over-withdrawal/under-withdrawal from grid compared to their scheduled forecast, which entails a penalty cost. The role of DISCOMs is equally important and their finances need to be robust to ensure quality operation. The solution to this could be Clustering Based OPEX Business Model.

Clustering Based OPEX Business Model

In the existing business model, DISCOMs will lose heavily with penetration of rooftop based solar generation. The solution is that DISCOMs need to become solar energy producers themselves in tandem with consumers. This alternative business model has its basis in utilizing

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rooftop space of consumers to generate solar energy under Operational Expenditure business model. In metros and big cities of India, the houses and their rooftops are physically connected to each other & these rooftops are normally un-utilized, especially in case of commercial establishments.

Generally a consumer lacks equity to install a solar setup for himself, especially when rooftop space is small and only low capacity installation is possible, making it financially unviable. But DISCOM can take up cluster of consumers to install one solar plant. If a locality has a group of 15-20 consumers and they have a combined rooftop space of 12,000 square feet, then a 100 KWp plant can easily be installed. The consumers in lieu for giving their rooftops can be compensated by crediting 10-20% of units generated from this SPV installation to offset their energy bill cost. For consumers this would be additional income from their otherwise unutilized rooftop. This is operational Expenditure (OPEX) model, wherein solar installation will be installed, operated and maintained by DISCOM. Along with this the physical infrastructure of DISCOMs like office building, distribution sub-stations etc can also be used to install solar generation setups. Consumers can also be given a choice to contribute equity to installation to get more percentage concession, which would decrease debt cost of DISCOM for installation. By linking consumer concession to generation, consumers will be encouraged to keep panels clean and thus obliterate any significant cost related to maintenance for DISCOMs; considering this in tandem with long warranty period on solar equipment, the operation and maintenance cost will be very low.

COST BENEFIT ANALYSIS

The capacity of clusters should be kept below 100 KW, so that connectivity could be provided at Low Tension Supply (440 Volts Phase to Phase) only as per electricity supply regulations of Punjab state (PSERC Supply Code) and no High Tension Supply (11,000 Volts Phase to Phase) equipment would be required and thus, it will help in saving cost for installation of solar generation setups (CERC, 2016).

Wherever distribution transformers (DT) having more capacity than connected load, there will be no technical issues concerning the grid tie and reverse power evacuation. Only when cluster of consumers install a rooftop solar generation unit with a capacity more than the capacity of distribution transformer (DT), to which they are connected, we would require augmentation of capacity of this given transformer. Central Electricity Regulatory Commission (CERC, 2016) has given benchmark costs for any solar generation undertaking for year 2016-2017 which is shown in Table 3.

Table 3. CERC Capital cost benchmark for 2016-17

S. No.	Particulars	Capital Cost norm proposed for FY 2016-17 (INR Lakhs/MW), for Solar PV Projects	Percentage(%) of Total Cost
1	PV Modules	328.39	61.96%
2	Land Cost	25	4.7%
3	Civil & General Works	35	6.6%
4	Mounting Structures	35	6.6%
5	Power Conditioning Unit	35	6.6%
6	Evacuation cost up to Inter-Connection Point (Cables & Transformers)	44	8.3%
7	Preliminary & Pre-Operative Expenses Including IDC & Contingency	27.63	5.21%
	Total Capital Cost	530.02	100%

Source: Central Electricity Regulatory Commission, 2016

There can be two possibilities for installing solar energy setups. Let's evaluate the estimated cost in both the cases. Case 1 includes 100 KWp Installation at Consumer Clusters and Case 2 includes 100 KWp at DISCOM Premises/Sub-Stations. The comparison of both the models is as follows:

Case 1: 100 KWp Installation at Consumer Clusters

Here case study is done assuming that installation is located in Punjab state, India. In this model, land cost of 4.7% is not required as only rooftop space is being used and in this model no separate rent will be given to consumers for using their roof. No detailed preliminary study and HT equipment will be required as installations will be in 100 KWp clusters, thus allowing being grid tied at LT voltage only according to PSERC Supply Code, further it will reduce 7% of the total cost.

- (i) Anticipated Generation³= 1380*100 = 1,38,000 units/year
- (ii) Capital Cost⁴= 53,00,000 INR
- (iii) Capital Cost = 46,80,000 INR (88.3% of Benchmark Cost according to CERC, 2016)
- (iv) Let's assume Debt : Equity Ratio⁵ = 70:30
- (v) Debt = 32,76,000 INR
- (vi) Debt Interest Rate = 7%
- (vii) Tenure of Debt⁶ = 20 yrs
- (viii) EMI for servicing Debt can be estimated with the help of following formula:

$$A = P \left[\frac{r(1+r)^n}{(1+r)^n - 1} \right]$$

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Wherein ; P = Principal Loan Amount

r = Monthly Interest Rate = Annual Interest Rate/(12*100)

n = Tenure of Loan

A = EMI for servicing Debt

(ix) Annual Cost of Debt = $A * 12 = 3,04,788$ INR/Year

(x) Consumer Concession = 10% of Total SPV Output

Thus Consumer Concession = 10% of 1,38,000 = 13,800 units/Year

Thus net generation⁷ at disposal of DISCOM after consumer concession = 1,38,000 - 13,800 = 1,24,200 units/year

(xi) Thus for 100 KWp installations-

Approx. Operational & Maintenance Cost = 30,000 INR/Year

(xii) Total Project Cost = Debt Cost + O&M Expenses = 3,34,788 INR/Year

(xiii) Net Generation Cost = Total Project Cost/Net Generation = 2.7 INR/unit Now there is provision of Renewable Energy Certificates (REC), which can be traded in market. (1 REC = 1 MWh = 1000 KWh)

(xiv) If we sell at floor price of REC's [CERC Order 2017] (Present floor price of 1 REC = 1000 INR)

Thus for 1,38,000 units generated, we get 138 REC's

Value of 138 REC's = 138*1000 = 1,38,000 INR; This amount can be saved in complying with RPO⁸ or can be garnered selling REC's in market.

(xv) Thus now net cost of generation is = $(3,34,788 - 1,38,000) / 1,24,200 = 1.58$ INR/unit

Thus cost of generating energy from these installations is definitely cheaper than buying from thermal plants. Also the fossil fuel based generation will get costlier with time, making this solar generation more lucrative.

(xvi) If we assume that these units will be sold at average 7 INR/unit, Then Rate of Return⁹ on investment would be = $1,24,200 * (7 - 1.58) * 100 / 46,80,000 = 14.38\%$ approx.

³ Punjab has average 1380 units/KWp Generation, (MNRE Solar Calculator)

⁴ CERC Benchmark cost = 53,000 INR/KWp (CERC, 2016)

⁵ NITi Ayog Report

⁶ Life of SPV Panels is taken 25 years [NITI Aayog Report]

⁷ Generation/KWp Punjab [MNRE Solar Calculator]

⁸ Renewable Purchase Obligation

⁹ We have not considered Tax Incidence for finding Rate of Return, as due to present loss making nature of DISCOM's in India, only Minimum Alternative Tax (MAT) is applicable.

Estimated Generation Cost variation with Interest Rate is as follows:

S.No	Interest Rate (%)	Per Unit Generation Cost (INR)
1	5	1.22
2	7	1.58
3	9	1.98
4	11	2.39

Case 2: 100 KWp at DISCOM Premises/Sub-Stations

Here the cost analysis is same as CASE-1, only difference is the absence of consumer concession in this case.

- (i) Total Project Cost = Cost of Debt = 3,34,788 INR/year
- (ii) Net Generation Cost = 2.43 INR/unit
- (iii) Selling REC's available from this installation- Value of 138 REC's = 138*1000 = 1,38,000 INR

This much amount can be saved in complying with RPO or can be garnered selling REC's in market.

Now Net Generation Cost = 1.42 INR/Unit

If we assume that these units will be sold at average 7 INR/unit, then

Rate of Return on investment = $1,38,000 * (7 - 1.42) * 100 / 46,80,000 = 16.45\%$

Estimated Generation Cost variation with Interest Rate is as follows:

S.No	Interest Rate (%)	Per Unit Generation Cost (INR)
1	5	1.09
2	7	1.42
3	9	1.78
4	11	2.16

WIN-WIN SITUATION

The various benefits provided by this proposed business model are as given below-

- (i) **Consumer's Saving:** If a consumer has yearly consumption of say 5000 units & energy tariff is assumed to be even at low value of 7 INR/unit by year 2022. Then- Yearly energy bill for 5000 units = 35,000 INR = 547 USD. Net saving due to given concession = $1380 * 7 = 9,660$ INR = 151 USD Which is a significant saving and actual price per unit will be then effectively 5 INR/unit, instead of 7 INR/unit.

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- (ii) **Reduced T&D Losses:** The power transmission losses are a sheer wastage of energy while transmitting long distance from generation plants to load centers. But such solar capacity being at load center would curtail such transmission losses (Priyangika, et. al., 2016).
- (iii) **Grid Stability:** Grid stability has been the most highlighted critique point regarding distributed solar generation system, as the intermittent nature of this induces grid instability. But when DISCOM will own such distributed solar plants, the power output can be cut off from these plants using remote operated circuit breaker devices for each cluster so as to save grid in rare exigency situations (Loan et.al., 2013)

CONCLUSION

This new alternative business model of taking up clusters of distributed rooftop solar generation under Operational Expenditure (OPEX) model by DISCOMs will certainly provide a solution to the problem of distributed rooftop solar energy generation being inimical to financial interests of DISCOM. This would push solar energy generation to a great extent and help achieve green energy targets and would become a perpetual source of cheap energy for DISCOMs, especially considering decreasing trend of cost of solar setup related equipment. The consumers will equally benefit by way of lower energy bills, by providing their unutilized rooftop space to DISCOMs as per this business model. Hence this solution provides a win-win situation for all.

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Employee Retention Strategies and Reasons for Attrition in Selected Textile Units of Gujarat

Dipal R. Patel¹

Abstract

Employee retention refers to the techniques employed by the management of a Company to help the employees stay in the organization for a longer period of time. A happy and a passionate workforce help managers in achieving individual and organizational performances. However, a manager's job is not only to hire best employees but also to retain them in the organization. In this research paper researcher has made an attempt to study the various Human Resource (HR) practices that help employee retention and encourage employee commitment in the organization. Objectives are to find different reasons for attrition and to study the factors that influence employee retention in the selected textile units. The primary data were collected from the employees of the selected textile units in Gujarat with the help of structured questionnaire. The statistical tools like descriptive statistics and Kruskal-Wallis Test were used wherever applicable, using SPSS. It was observed that getting higher salary in other company, getting other job easily and change in the quality of production are among the few factors which were most influential in employee retention.

Keywords: Employee retention, Attrition, Job satisfaction & HR Practices

Introduction

Human Resource (HR) practices are related to the satisfaction of the employees, enhancing the commitment of employees towards the organization, and building a healthy competitive and cultural environment. Practice can be in the form of an activity, a rule, a process, a system or a simple technique to get work done through other people. Healthy HR practices positively affect the overall performance of the organization. Good HR practices are those that contribute to one or more of the three C's: Competencies, Commitment, and Culture. They need to be identified and implemented effectively in terms of cost, should be reviewed and revised frequently to enhance their effectiveness.(Ruchi, 2014)

Basically employee retention is associated with various policies and practices due to which employees stay in the organization for a longer period of time. Every organization invests time and money to train a newly joined employee and attempts to bring them at par with the existing employee. When employees leave their job once completely trained the company faces severe financial and manpower loss. Company must put some efforts for the development of the

¹ Assistant Professor of Management Subject, R. N. Patel Ipcowala School of law and Justice, Vallabh Vidyanagar, Gujarat

individuals and that helps in growth and enhancement of the employees in their routine task so they enjoy their work and job.

India's textiles sector is one of the oldest industries in Indian economy dating back several centuries. Even today, textiles sector is one of the largest contributors to India's exports with approximately 11 percent of total exports. The textiles industry is also labour intensive and is one of the largest employers. The government of Gujarat intends to invest - USD 3.28 billion in the textile industry in next 5 years which will also help create 1 million jobs in the sector. Gujarat is a leading state in textile sector with 1,560 medium and large textile units and having 18 textile-related product clusters.

The contribution of Gujarat in the national textile industry is noteworthy. Textile Industry of Gujarat is largest producer i.e.33Percent with production of 93 lakh bales in 2012-13 and exports is around 60 Percent of cotton in the country, where in 50 Percent of the country's art silk fabric is produced in Surat, industry is largest producer of denim in India i.e.65 Percent , it has highest number of medium and large textile processing houses over 600, it contributes to over one-fourth of the country's technical textile output. The industry is largest manufacturer of man-made and filament fabric and second largest decentralized power loom concentrating state (50,000 looms (cotton)/8 lakh filament).

Literature Review

Sohail, (2011) have reported in their work that all the companies irrespective of their size face a problem of retention of their employees because employees leave to seek better opportunity or higher salary. Some other reasons for leaving the job are culture, lack of recognition, environment, policies of the organization and the relationship with company and co-workers. So from the paper, it has been observed that employee retention is a global problem as also in Pakistan.

Banerjee, (2014) has found in his work that there is a correlation between firm activities and employee participation in decision making, whenever employee is given chance in decision making in firm they are found to perform well. In this article author has given example of high range of dedication to employee participation in decision making to improve their functioning. There is a necessity for industrializing firms. In this competitive world employee participating in decision making is considered as the best approach for mounting firm functioning.

Umarji, (2013) in his paper mentioned that around 40 textiles firms Closed shops in Surat due to financial crisis. Consequently around 14000-15000 workers lost their employment. Author mentioned that the Union Minister of State for Textiles Mr. Lakshmi cited that around 555 cotton and manmade textile mills were closed in Mumbai, Surat, Ujjain & Kanpur. However these employees were absorbed by the industry but the industry still faced shortage due to NREGA & rise in wages. Mr. Lakshmi stated that around 168 units and 2,90,000 workers in different states were found to have been adversely affected. The other reason for unemployment

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was the rising wage rate. A rise in the wages from Rs. 250 per day to Rs 350-400 per day affected the overall production cost to a unit and industry both.

Khare, (2013) analyzed in his paper that most of the companies of power loom thrive, yet they indulge in exploitation. Many companies indulge in labour exploitation like taking advantage of the immobility of workers, employing childlabour and not providing even basic amenities such as toilet, drinking water, ventilation, and fan. Darkness and layers of grease on the floor are also other problems. Many companies are not even registered to save the tax. Workers in some companies donot have a guaranteed wage on monthly basis, but instead, get paid on piece rate system.

Karthikeyan & Sivakami, (2016) have examined in their paper that management needs to keep a positive attitude towards absenteeism, even though it is impossible to get rid of absenteeism completely. The provision of various facilities to decrease absenteeism bound to involve an important financial commitment for the management. The major reasons for absenteeism in the organization are the activities and policies of the organization. The reduction in absenteeism will be helpful in improving the productivity.

Shaji & Kinslin, (2014) have examined the causes of attrition and its effect in IT industry. In their research they observed that male workers leave the job more often as compared to the female workers and this lead the organization to knowledge loss, impact to service, and the income of the firm and to the work environment. They identified different reasons for employee's attrition as lack of recognition, lack of future growth, differences with the managers, poor salary or compensation. Managers play a vital role in the retention of the employees. A well managed, organized, unbiased, trustworthy, and a motivating manager would help in reducing attrition rate with the support of the organization.

Researcher in the field are found to have experienced various reasons for attrition. In this context, it is attempted to examine the presence of such reasons in the selected textile units for the present study.

Objectives

1. To find different reasons for attrition in selected Textile Units of Gujarat.
2. To study the factors that influence employee retention in the selected textile units.

Scope of the study

A study on human resource retaining problems of selected Textiles units of Surat, have been examined from 2015 to 2017. An attempt is made to identify problems related to the retention of human in selected Textile Units.

Research Methodology

The study has used descriptive and convenience sampling method for selecting samples

and the questionnaire was distributed to the selected respondents for the research work. The population for this study comprised of employees working in the selected textile units. A sample size of 280 from selected textiles units was chosen for this study. The primary data was obtained based on demographic attributes and Employee Retention Strategies. Secondary data were also used for this study. Relevant data and information have also been collected from various articles, reviews, and research papers published in different human resource management journals and periodicals related to the topic of study.

Data collection and Data Analysis

The sample size for the current research is 280 employees of selected textile units and convenience sampling method was used to select the sample size. The primary data which were collected with the help of the structured questionnaires were coded in the SPSS statistical software, to convert the primary data into a suitable form. Once the data were transferred into the software the data analysis was initiated. The statistical tools used are descriptive statistics and Kruskal-Wallis Test wherever applicable.

Data Analysis

Following is the analysis of the data on the basis of the responses from the respondents.

Table 1. Ranking of Reasons for attrition

Sr. No.	Descriptive Statistics						
		N	Minimum	Maximum	Mean	Std. Deviation	Rank
1	Change in the quality of production	280	1	7	3.46	1.135	5
2	Due to Residential address change	280	1	7	4.66	1.007	3
3	Getting higher salary in other company	280	1	7	6.53	1.015	1
4	Having differences of opinion with superior	280	1	5	3.81	1.032	4
5	Working on the machine is unfavorable	280	1	6	2.04	.998	7
6	Getting other job easily	280	1	7	5.27	1.920	2
7	To go to native place during summer	280	1	7	2.23	1.788	6

Source: Primary Data

Interpretation

Table 1 presents the ranking of different reasons for job attrition given by the respondents. Getting higher salary in other company was ranked first as a reason to leave the job, second was getting other job easily, third was due to the change in residence, fourth rank was having differences of opinion with superior, fifth was the change in the quality of the production, sixth rank was returning back to the native place during summer and last rank was given to unfavorable working condition or situation on the machine due to change in technology or machinery.

EMPLOYEE RETENTION

Kruskal-Wallis Test for the current research paper data analysis

H_{0A} : The ranking of employees in different Age groups on various factors that influenced to remain in the organization are same.

H_{1A} : The ranking of employees in different Age groups on various factors that influenced to remain in the organization are not same.

Table 2. Factors that influence employee retention according to the age groups

	Ranks			Test Statistics ^{a,b}		
	Age	N	Mean Rank	Chi Square	df	Asymp. Sig.
Change in the quality of production	18 to 25	90	133.56	10.447	4	.034
	26 to 35	149	150.75			(S)
	36 to 45	18	125.72			
	46 to 55	20	123.45			
	More than 56	3	42.00			
	Total	280				
Due to Residential address change	18 to 25	90	149.53	3.855	4	.426
	26 to 35	149	134.18			(NS)
	36 to 45	18	145.83			
	46 to 55	20	148.48			
	More than 56	3	98.50			
	Total	280				
Getting higher salary in other company	18 to 25	90	146.72	2.337	4	.674
	26 to 35	149	135.51			(NS)
	36 to 45	18	152.11			
	46 to 55	20	139.68			
	More than 56	3	137.67			
	Total	280				
Having differences of opinion with superior	18 to 25	90	143.17	5.318	4	.256
	26 to 35	149	145.41			(NS)
	36 to 45	18	118.72			
	46 to 55	20	110.15			
	More than 56	3	149.83			
	Total	280				
Working on the machine is unfavorable	18 to 25	90	137.01	3.440	4	.487
	26 to 35	149	137.51			(NS)
	36 to 45	18	152.56			
	46 to 55	20	166.95			
	More than 56	3	144.83			
	Total	280				

To go to native place during summer	18 to 25	90	129.60	3.413	4	.491
	26 to 35	149	145.98			(NS)
	36 to 45	18	139.61			
	46 to 55	20	144.33			
	More than 56	3	175.33			
	Total	280				
a. Kruskal Wallis Test						
b. Grouping Variable: Age						

Source: Primary Data

Interpretation

As per Table 2 the employees were grouped based on age Group. Chi-square test was applied. Since the significance value was greater than 0.05 for all the factors except for the change in the quality of the production, it may be inferred that ranking of employees in different age group regarding change in residential address, getting higher salary in other company, having differences of opinion with superior, working on the machine is unfavorable, getting other job easily and to go to native place during summer influence on employee retention remained the same, whereas towards change in the quality of production was not same.

H_{0B} : The ranking of employees having different work experience on various factors that influenced employee retention in the organization are same.

H_{1B} : The ranking of employees having different work experience on various factors that influenced employee retention in the organization are not same.

Table 3. Factors that influenced employee retention in the organization based on working experience

	Ranks			Test Statistics ^{a,b}		
	Experience	N	Mean Rank	Chi Square	Df	Asymp. Sig.
Change in the quality of production	Less than 1 year	55	131.85	13.781	4	.008
	1 to 3 years	135	141.94			(S)
	3 to 5 years	55	121.07			
	6 to 10 years	30	177.80			
	More than 10 years	5	186.80			
	Total	280				
Due to Residential address change	Less than 1 year	55	156.45	8.180	4	.085
	1 to 3 years	135	137.10			(NS)
	3 to 5 years	55	147.05			
	6 to 10 years	30	112.08			
	More than 10 years	5	155.20			
	Total	280				

EMPLOYEE RETENTION

Getting higher salary in other company	Less than 1 year	55	152.84	3.520	4	.475
	1 to 3 years	135	134.95			(NS)
	3 to 5 years	55	142.61			
	6 to 10 years	30	142.07			
	More than 10 years	5	122.00			
	Total	280				
Having differences of opinion with superior	Less than 1 year	55	141.99	11.883	4	.018
	1 to 3 years	135	140.03			(S)
	3 to 5 years	55	122.28			
	6 to 10 years	30	179.35			
	More than 10 years	5	104.20			
	Total	280				
Working on the machine is unfavorable	Less than 1 year	55	132.26	3.605	4	.462
	1 to 3 years	135	145.60			(NS)
	3 to 5 years	55	145.90			
	6 to 10 years	30	121.47			
	More than 10 years	5	148.10			
	Total	280				
Getting other job easily	Less than 1 year	55	137.65	1.725	4	.786
	1 to 3 years	135	145.63			(NS)
	3 to 5 years	55	137.32			
	6 to 10 years	30	127.62			
	More than 10 years	5	145.70			
	Total	280				
To go to native place during summer	Less than 1 year	55	128.83	6.456	4	.168
	1 to 3 years	135	136.75			(NS)
	3 to 5 years	55	160.49			
	6 to 10 years	30	146.63			
	More than 10 years	5	113.50			
	Total	280				
a. Kruskal Wallis Test						
b. Grouping Variable: Experience						

Source: Primary Data

Interpretation

As per Table 3 the employees were grouped based on working experience. Chi-square test was applied. Since the significance value is greater than 0.05 for all the factors except for change in the quality of production and having differences of opinion with superior, it may be inferred that ranking of employees in different work experience group regarding change

in residential address, getting higher salary in other company, getting other job easily, working on the machine is unfavorable and to go to native place during summer influence on employee retention remained the same, whereas towards change in the quality of production and having differences of opinion with superior were not same.

H_{0c} : The ranking of employees in different Status/Level on various factors that influenced employee retention in the organization are same.

H_{1c} : The ranking of employees in different Status/Level on various factors that influenced employee retention in the organization are not same.

Table 4 : Factors that influenced employee retention in the organization based on Status/Level

Ranks				Test Statistics ^{a,b}		
	Status	N	Mean Rank	Chi-Square	Df	Asymp. Sig.
Change in the quality of production	Top Level	3	247.00	6.212	2	.045
	Middle Level	52	142.38			(S)
	Floor Level	225	138.64			
	Total	280				
Due to Residential address change	Top Level	3	149.67	2.040	2	.361
	Middle Level	52	153.22			(NS)
	Floor Level	225	137.44			
	Total	280				
Getting higher salary in other company	Top Level	3	126.00	1.285	2	.526
	Middle Level	52	149.20			(NS)
	Floor Level	225	138.68			
	Total	280				
Having differences of opinion with superior	Top Level	3	117.83	1.430	2	.489
	Middle Level	52	130.37			(NS)
	Floor Level	225	143.14			
	Total	280				
Working on the machine is unfavorable	Top Level	3	144.83	.911	2	.634
	Middle Level	52	149.29			(NS)
	Floor Level	225	138.41			
	Total	280				

EMPLOYEE RETENTION

Getting other job easily	Top Level	3	110.67	7.147	2	.028
	Middle Level	52	116.67			(S)
	Floor Level	225	146.40			
	Total	280				
To go to native place during summer	Top Level	3	106.17	.962	2	.618
	Middle Level	52	146.19			(NS)
	Floor Level	225	139.64			
	Total	280				
a. Kruskal Wallis Test						
b. Grouping Variable: Status/Level						

Source: Primary Data

Interpretation:

As per Table 4 the employees were grouped based on Status/Level. Chi-square test was applied. Since the significance value is greater than 0.05 for all the factors except for the change in the quality of production and getting other job easily, it may be inferred that ranking of employees in different work experience group regarding change in residential address, getting higher salary in other company, having differences of opinion with superior, working on the machine is unfavorable and to go to native place during summer influence on employee retention remained the same, whereas towards change in the quality of production and getting other job easily were not same.

Conclusion

Getting higher salary in other company and getting another job easily were observed to be the major reasons for attrition in the textile industry. Accordingly textile industries can adopt certain suggestions to stop attrition and retain employees. Organizations should offer more salary, Proper coordination and good superior-subordinate relationship should be maintained, all employees should be treated equally and there should be no discrimination. The company should provide basic facilities like canteen, noise free environment and proper lighting facilities for their employees. The company should provide enough time to improve the quality of the product if different types of products are manufacturing in the industry. If the textile industry introduces such suggestions and timely reviews its HR policies, employee retention would be easily accomplished. Satisfied employees shall also contribute better to the development of the textile units and the industry at large.

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OUR CONTRIBUTORS

S.S. Kalamkar	Agro-Economic Research Centre, Sardar Patel University Vallabh Vidyanagar
M. Swain	-do-
S.R. Bhaiya	Cost of Cultivation Scheme, Agro-Economic Research Centre, Sardar Patel University Vallabh Vidyanagar
Kalpana Kapadia	Agro-Economic Research Centre, Sardar Patel University Vallabh Vidyanagar
H. Sharma	-do-
M. Makwana	-do-
V.K. Boyal	National Dairy Research Institute, Karnal, Haryana
Bigi Thomas	Department of Social Work, Sardar Patel University, Vallabh Vidyanagar

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Estimation of Changes in Income and Cost of Production owing to Changes in Inputs and Hybrid Seeds for Major Crops of Gujarat

S.S. Kalamkar¹, M. Swain² and S. R. Bhaiya³

Abstract

The study analyzes role of various agricultural inputs, particularly hybrid seeds in enhancing crop productivity and farmers income in Gujarat. Seed is basic and most critical input for sustainable agricultural growth and response of all other inputs depends on quality of seeds to a large extent. It is estimated that direct contribution of quality seed alone to total production is about 15-20% and it can be further raised up to 45% with efficient management of other inputs. Green Revolution during late sixties bears witness to this truth. The volume growth has come through increased Seed Replacement Rate (SRR) of major crops like wheat and cotton, while major concern of low SRR of majority of other crops. The SRR of moog (37%), urad(40%) and arhar (33%), wheat (33%), gram (27.5%) and summer groundnut (10%) has also been very low. The main limitations were lack of awareness about seeds, seed treatment methods and government subsidy programmes. Therefore, it is necessary to generate awareness among the farmers about tupe, quality and usefulness of seeds. The level of awareness and use of organic fertiliser was found to be very low among the farmers.

Keywords: Agricultural Inputs, Seed, Cost of Cultivation, Farm Income

JEL Classification: Q12, Q16, Q12, D24, D61

Introduction

The introduction of high-yielding-varieties of seed (HYVs) and the increased use of chemical fertilizers and irrigation were the major features of Green Revolution, which provided the increase in production, needed to make India self-sufficient in food grains in India. Among the inputs, seed is a critical and basic input for enhancing agricultural production and productivity in different agro-climatic regions. Most of the breakthrough in agricultural research is packed in the form of seed delivered to the farmers. In fact, efficacy of other agricultural inputs such as fertilizers, pesticides and irrigation is largely determined by the quality of seed. Seed quality is estimated to account for 20-25 percent of productivity. The Green Revolution in India during the late sixties and seventies bears witness to this truth. And lately, during the decade of 2000s, Bt

¹ Director, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar

² Research Officer/Assistant Professor, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar

³ Field Officer/Assistant Professor, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar

cotton seeds, single cross corn hybrids and hybrid vegetables have shown spectacular results. The volume growth has come through increased Seed Replacement Rate (SRR) of major crops like wheat and cotton. It is, therefore, important that quality seeds are made available to the farmers. However, due to use of hybrid seeds, fertilizers, insecticides and pesticides, cost of cultivation has also gone up considerably. On the other hand, the constraints such as unavailability of good quality seeds in time and at reasonable price considerably affect the yield potential of crops. In this context, present study analyzed the role of various agricultural inputs, particularly hybrid seeds in enhancing the crop productivity and farmers income in Gujarat.

Data and Methodology

The study is based on both primary and secondary data. The secondary data were drawn from various published sources and related websites. The primary data have been collected from 1800 sample farmer households selected from 60 village clusters of Gujarat on major eleven crops, viz. paddy, bajra, maize, wheat, tur, groundnut, castor, sesamum, rapeseed-mustard, cotton and onion (Table 1).

HYV Seeds Economy of Gujarat

Gujarat has aggressively pursued an innovative agriculture development programme by liberalizing markets, inviting private capital, reinventing agricultural extension, improving roads and other infrastructure (Dholakia, 2010; Kumar et al., 2010; Swain et al., 2012). Among various states, Gujarat has been a leading one in technology led growth in agriculture. Technology development and diffusion is a key driver of agricultural growth, fuelling cotton production other farm output and raising the farmers' income substantially. Due to technology intervention, the share of cash crops like cotton and horticultural crops has increased substantially during the last two decades. During 2000s, Bt cotton seeds and hybrid maize seeds have shown spectacular results in the state. The volume growth has come through increased SRR of major crop like cotton in the state. To complement with good agricultural growth in state, the availability of quality/certified seeds has been made available as required in various part of Gujarat. Both private and public seed sector have contributed to the agricultural growth story in the state. While public sector has played a role in production and distribution of HYV seeds of cereals crops(wheat, paddy, bajra, jowar and maize) while private seed sector has played a pivotal role in developing and promoting the use of Bt cotton seeds. In Gujarat alone, about 26 private seed companies have registered 113 varieties of Bt cotton seeds. Not only has the yield more than doubled in just five to six years, at present more than 80% of the total cotton area in the state has come under Bt variety.

Growth in Area and Production of HYV Crops in Gujarat

During the initial phase of green revolution, the cereal crops were given priority for technological interventions and therefore total area HYV cereals have tremendously increased

HYBRID SEEDS

from 33.4 thousand ha in 1966-67 to 2170.9 thousand ha in 2000-01, an increase by around 65 times (Table 2). During last five decades, the total area under HYV cereals has increased by a growth rate of 11.03 per cent. Among the HYV cereals, the share of area under HYV bajra in total area under HYV cereals has declined, whereas share of paddy and wheat has increased over last four decades.

Though there has been substantial increase in area under HYV in the state, the inter-district variations in area under HYVs of five major cereal crops have also increased. There has been a very good growth in total area sown under some major crops such as groundnut, Bt cotton, bajra and maize. The area under groundnut and HYV cotton has increased from 3.2 lakh ha and 2.99 lakh ha in 2003-04 to 16.6 lakh ha and 21.75 lakh ha in 2013-14. Similarly, there has been also an impressive growth in certified seed distribution in case of majority of selected crops except bajra and sesamum. However, HYV seed distribution has declined by 59.6 per cent and 36.7 per cent respectively for these two crops (bajra and sesamum) during 2013-14 over 2003-04.

The growth in SRR for HYV cotton, maize, bajra jowar and Rapeseed-mustard has been quite good (Figure 1). The SRR for all these crops have been around 100 per cent. However, in the case of variety groundnut and variety cotton which are the pride of Gujarat, SRR has been as low as 10.0 per cent and 65.0 per cent respectively. The SRR of moong, urid and arhar has also been very low (37%, 40%, 33%, respectively) during 2013-14. Among rabi and summer crops, the SRR of wheat, gram and summer groundnut has been only 33 per cent, 27.5 per cent, 10 per cent, respectively during the corresponding period. Among the HYV cotton seeds distributed, about 99.5 per cent was truthful labelled seed (2013-14). Among other crops, maize, bajra and summer groundnut were having more proportion of truthful labelled seeds among them. Among rabi and summer crops, majority of seeds (except wheat and moong) were found to be truthful labelled. While entire summer groundnut seeds were truthful labelled, the entire summer moong were certified labelled.

The seed scenario in the state has undergone rapid change. The share of private sector in distribution of total certified/quality seeds during kharif 2013 was 71.6 per cent compared to 28.4 per cent of government seed sector share. In the case of paddy, the share of private and public seed sectors was as high as 82.8 per cent and 17.2 per cent respectively. The share of government seed sector in the cases of HYV cotton, maize and bajra was as low as 1.9 per cent, 8.0 per cent and 2.1 per cent, respectively during kharif 2013. Though the private seed sector has dominated the HYV seeds production and distribution with larger share in case of almost all crops during all three seasons (except summer groundnut with 61.3% share), the performance of government seed sector is relatively better in the case of kharif groundnut (41.7%), variety cotton (37.9%), gram (29.2%) and rapeseed-mustard (24.6%). Among government agencies, Gujarat State Seeds Corporations Ltd and National Seeds Corporations Ltd were the major players.

Share of Seed Cost in Total Cost of Cultivation in Gujarat

As per CACP data, the share of seed cost in total operational cost was as high as 46.1 per cent for onion and as low as 3.5 per cent for Sesamum (Table 3). The share of seed cost in total operational cost for cotton, groundnut and wheat was 7.1, 27.3 and 16.8 per cent, respectively. Though the average seed cost was the lowest for rapeseed-mustard, CAGR in share of seed cost during last seven years was the highest (14.9%), followed by onion (13.6%). The share of seed cost has, in fact, declined for cotton, maize and paddy by a rate of 8.6, 2.2 and 0.2 per cent, respectively. The declining share of cost of cotton seed may be due to availability of more Bt cotton variety in the market at lower rate as compared to seed rate paid in initial years (after introduction of Bt in July 2002). It is very important to note here that in case of onion, seed cost is more than one third of operation cost which indicates the importance of seed availability and cost of seed in the market.

Findings from Field data:

Cropping Pattern

It was observed that more than 66 percent selected farmers had grown cotton crop. It was expected because Gujarat is the one the largest producer of cotton in India, accounts for 20.87 percent of area and 35.68 percent of total production in the country during 2012-2013. The second most important crop which large number of farmers had grown was wheat, followed by bajra, groundnut, paddy, castor, rapeseed mustard, tur and other crops. Though onion crop was grown by very few numbers of farmers, it is one of the important crops and plays very important role in food basket. Gujarat accounts for about 6 percent area and about 9 percent production of onion in country during 2012-13, with record productivity level of 24.11 tonnes per ha. Among the different categories of farmers, less number of marginal and small farmers had preferred to grow crops like maize, seamum, castor and onion, whereas the share of these group of farmers in cultivation of remaining crops is comparable to other groups of farmers.

During the reference year 2012-13, around 30 percent of gross cropped area of sample farmers was under cotton crop. Wheat crop accounted for about 11 percent area in cropping pattern of selected households (Table 4). Groundnut and paddy were other two important crops grown by selected farmers which accounted 8 percent each in gross cropped area.

As a crop group, it was observed that cereals crops accounted for about 30 percent of gross cropped area, oilseeds accounted for about 17 percent area whereas pulses accounted for about 3 percent area. The area under spices (cumin, fennel, garlic, etc) has been increasing in the state and it accounted for about 2.3 percent area of cropped area of selected households.

Access and Use of HYV Seeds & Other Inputs

The results reveals that the percentage of farmers cultivating the HYV crop to total number of farmers cultivating that particular crop varied from as low as 19.05 percent in onion

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to as high as 99.35 percent in bajra. It indicates that almost all the farmers those who had grown bajra during kharif and summer seasons during 2012-13 used hybrid seed. Onion crop generally grown in late kharif/rabi season mostly in Bhavnagar, Rajkot and Jamnagar district of state and farmer generally produced seed on their farm, or purchase from fellow farmer or they use kanzi (half grown bulb of onion) for onion production. That may be the reason behind very low share of onion farmers using HYV seed to total farmers. The crops in which share of farmer cultivating HYV crop to total farmer had recorded significantly in case of cotton, castor, rapeseed mustard. Except tur which had only 44 percent farmer households, the share of farmer in remaining crop ranged between 48-67 percent of total area. Across the different size groups of farmers, almost similar trend was noticed.

The percentage of area under HYV seed to total cropped area of particular crop found highest in case of castor (99.1 percent) followed by bajra (90 per cent), cotton (75.9 percent) and the lowest was recorded in groundnut (9.0 per cent). It indicates that almost all the farmers those who had grown castor crop during kharif season during 2012-13 used hybrid seed. Groundnut crop generally grown in kharif season and farmer generally use seed produced on their farm, or purchase from fellow farmer. That may be the reason behind very low rate of use of hybrid seed in groundnut cultivation. Unlike share of farmers in total number of farmers growing hybrid seed, more than 54 percent of onion area was covered with hybrid seed.

Cost of Cultivation of Selected Crops: HYV vs Local

The cost of cultivation is worked out putting alone crop production with hybrid seed. The share of seed cost in total varies from 3.6 per cent in case of rapeseed-mustard to 31.2 per cent in case of groundnut. The share of hybrid/bt seed cost in total cost of cultivation of cereal crops ranges from as low as 6.0 percent in bajra to as high as 13.3 percent in Maize. In case of tur, cost of hybrid seed accounted for 4.6 percent. In case of oilseed crops, groundnut accounted highest share of 29 percent in total cost of cultivation and lowest share of cost on seed was recorded in case of rapeseed mustard. The cost of hybrid/bt seed in case of cotton cultivation accounted for 9.5 percent of total cost. The cotton seed available in the market and which has demand for is bt cotton seed which provides the safeguard against bollworm attack. The only vegetable crop onion for which farmers had to purchase seed from market at very high rate and thus accounted for around one fourth of total cost on seed only.

The share of local seed cost in total cost of cultivation of cereal crops ranges from as low as 1.8 per cent in maize to as high as 6.8 per cent in paddy. In case of tur, cost of local seed accounted for 3.5 per cent. In case of oilseed crops, as seen earlier, groundnut accounted highest share of 31.9 per cent in total cost of cultivation and lowest share of cost on seed was recorded in case of rapeseed mustard (1.3 per cent). The cost of local in case of cotton cultivation accounted for 7.4 per cent of total cost. The cost of onion seed accounted for about 28 per cent in total cost of cultivation. The share of cost of seed of local variety was estimated to much lower than hybrid seed. The profit analysis indicated that the profit per hectare cost of cultivation using

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local seed was recorded highest in case of onion (Rs. 63209/-) followed wheat (Rs. 22063/-) and rapeseed mustard (Rs. 21736/-). The same was negative in case of maize (Rs.2679/-).

Share of HYV and Local Seed Cost

The share of hybrid/bt seed cost in total cost of cultivation ranges from as low as 3.6 per cent in rapeseed-mustard to as high as 30.1 per cent in onion. Among cereals, the share of hybrid/bt seed cost in total cost of cultivation varied from as low as 6.0 per cent in bajra to as high as 13.3 per cent in wheat. In case of tur, cost of hybrid seed accounted for 4.6 per cent. In case of oilseed crops, as seen earlier, groundnut accounted highest share of 30.6 per cent in total cost of cultivation and lowest share of cost on seed was recorded in case of rapeseed mustard (3.6 per cent). The cost of hybrid/bt seed in case of cotton cultivation accounted for 9.3 per cent of total cost. The cotton seed available in the market and which has demand for is bt cotton seed which provides the safeguard against bollworm attack. The only vegetable crop, i.e. onion for which farmers had to purchase seed from market at very high rate and thus accounted for around one fourth of total cost on seed only (30.1 per cent).

The gap between HYV seeds cost and local seeds cost as a percentage of total cost of cultivation was observed to be much larger in case of onion and maize. In both the cases, the share HYV seeds cost is much higher than the share of local seeds cost. Groundnut was the only crop, in which case, the share of local seeds cost was found to be much larger than the share HYV seeds cost.

Changes in Productivity and Farmer's Income

Selection of the right variety of seed is extremely important when it comes to the cultivation of a crop. Different seeds behave differently according to the soil, climate, irrigation and other inputs of an area. A variety of seed that produces a quality crop and fetches a premium price in one region may be totally rejected in another region. This rejection may sometimes occur over districts and even through villages. Since, every farmer aims to get the maximum return for his produce, prudent selection of the seed variety is vital. High yields and good produce can be achieved only when seeds are used wisely. The main advantages of High Yielding Variety seeds are yielding of farms with the use of HYV seeds in high compared to the use of traditional seeds. HYV seeds give better quality yielding. The study reveals that almost in all crops, productivity level of HYV crop was found higher than local seed crop. The highest difference was recorded in case of cotton crop, which may be due to high yield level of Bt cotton. It is important to note here that due to use of HYV seed and other supporting inputs, the cost of cultivation of most of the selected crops was higher than the local seed crops. Thus increase in productivity may help in increase in income subject to realisation of remunerative prices.

Thus, it is very much clear from the results that the average yield of crop as well as level of income under HYV seed crop was higher than the local seed crop. Except local variety of maize, no other crops yielded negative returns per hectare to the farmers (Figure 3). However,

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the farmer's income per quintal of output was found to be negative in case of four local varieties of crops (paddy, maize, groundnut and cotton) (Figure 4). This is mainly because of poor quality of local seeds and cultivation of these crops under rainfed conditions that resulted in poor yields compared to high costs incurred.

Adoption/Constraints in Use of HYV Seeds & Other Inputs

The main constraints faced by the respondents in adopting HYVs were poor crop germination, unavailability of seed in adequate quantity and in appropriate time and lack of latest knowledge. The main limitations as reported by the respondents were lack of awareness about seeds tag colour (foundation seeds, certified seeds and truthful seeds), seed treatment methods and government programmes on subsidy on seeds. Thus, it indicates that farmers are unaware about the stages of seed made available to them, about seed treatment as well as government programme related to seed. The state seed certification agency as well as state extension agency should work out plan to disseminate knowledge and technical knowhow to the farmer.

The selected farmers had faced constraints in use of other inputs as well. Among the various problems faced by farmer, more severity was observed in case of non availability of credit, non-availability of other inputs, poor quality of other inputs, poor pod/grain setting and Incidence of insect/pest/diseases. Besides, inadequate knowledge about disease and pest management, weed infestation, non-availability of human labour, risk of crop failure/yield variability due to biotic & a biotic stresses as well as high cost of other inputs were some of the problems faced by the farmers in cultivation of selected crops.

About 30 percent of farmer households had suggested that good quality seeds should be made available. Around 20 percent of farmer household had suggested that new insect pest resistant variety should be developed in order to minimize the use of and cost on insecticides and pesticides. Besides, farmers had suggested that timely availability seed (about 15 percent) with adequate quantity of seed (about 9 percent) should be ensured by the government. About 11 percent of farmer households had suggested that prices of seed should reduced as well as black marketing of seed should be checked by local authority in order to benefit the resource poor farmer. It was also suggested that more number of farmers should be involved/ given training through farm demonstration/ Krishi Mahostav/ KVK/ SAUs. It was very upsetting to note here that very few farmers had made suggestions on important issues related to seed which has direct impact on improvement of production such increasing seed replacement ratio, seed treatment, failure of certified seed and compensation thereof, over use of seed, etc.

Policy Implications:

It was observed that SRR of moong, urad, arhar as well as wheat, gram and summer groundnut has also been very low. Thus, the SRR of majority crops in the state need further improvement. The main limitations were lack of awareness about the seeds they are using such as the tag colour of seeds, seed treatment methods and government programmes on subsidy on

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seeds etc. Thus it is necessary to generate awareness among the farmers about the nature, quality and usefulness of the seeds they are using. Some of selected farmers also faced difficulties in getting good quality seeds at right prices. The seeds were mostly purchased from local markets. Since the farmers did not have sufficient knowledge about the available seeds and they did not have any other alternatives, they were forced to purchase those seeds from the local traders, who are normally profit seekers. There is a need to improve marketing regulations so as to keep the check on prices and the black marketing of seeds. The study found that the level of awareness and use of organic fertiliser is very low among the farmers. It is suggested to promote the organic farming through some policy incentives.

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Table 1 : Selection of Sample Farmers from different Agro-Climatic Zones of Gujarat

Zone	Agro-climatic Zones	No. of Sample Talukas	Allotment of 60 Clusters	Area under Study Crops as % to GCA of Zone	Total sample farmers
I	South Gujarat (Heavy rain area)	2	2	58.71	60
II	South Gujarat Zone	2	2	51.75	60
III	Middle Gujarat Zone	7	7	83.09	210
IV	North Gujarat Zone	13	13	78.28	390
V	Bhal & Coastal Area Zone	3	3	84.51	90
VI	South Saurashtra Zone	13	13	94.17	390
VII	North Saurashtra Zone	12	12	89.81	360
VIII	North West Zone	8	8	67.47	240
	All	60	60	80.51	1800

Note: A cluster is comprised of 1-3 villages as per sample requirement.

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Table 2: Growth of Area under HYV Cereal Crops in Gujarat (1966-67 to 2009-10)
(Area in 00' ha)

Year	Paddy	Wheat	Jowar	Bajra	Maize	Total Cereals
1966-67	4 (1.2)	7 (2.1)	4 (1.2)	288 (86.2)	31 (9.3)	334 (100.0)
1970-71	491 (6.2)	1743 (22.1)	48 (0.6)	5573 (70.5)	46 (0.6)	7901 (100.0)
1980-81	3051 (14.1)	4750 (21.9)	841 (3.9)	11959 (55.1)	1105 (5.1)	21706 (100.0)
1990-91	5051 (19.6)	5204 (20.2)	2498 (9.7)	10886 (42.3)	2103 (8.2)	25742 (100.0)
2000-01	4240 (22.0)	2600 (13.5)	480 (2.5)	9720 (50.3)	2270 (11.8)	19310 (100.0)
2009-10	5980 (24.0)	8540 (34.2)	660 (2.6)	6460 (25.9)	3300 (13.2)	24940 (100.0)
Compound Annual Growth Rates (%)						
1966-67 to 1970-71	383.10	192.40	117.22	112.00	37.73	118.66
1970-71 to 1980-81	20.15	11.67	25.81	7.24	36.48	10.15
1980-81 to 1990-91	5.73	1.25	13.57	0.09	3.83	2.28
1990-91 to 2000-01	-1.74	-6.70	-15.21	-1.13	0.77	-2.83
2000-01 to 2009-10	3.89	14.13	3.60	-4.44	4.24	2.88
1966-67 to 2009-10	18.07	17.53	12.30	7.33	11.19	10.30

Note: Figures in parentheses are the percentages of total

Table 3. Share of Seed Cost in Total Cost of Cultivation of Selected Crops (2004-05 to 2010-11)
(Percentage to total operational cost C1)

Year	Wheat	Paddy	Maize	Bajra	Tur	Groundnut	R&M	Sesamum	Cotton	Onion
2004-05	12.7	10.8	7.9	4.5	5.7	23.5	1.8	3.0	12.2	21.5
2005-06	13.3	10.8	7.9	5.6	3.5	23.3	1.7	2.6	13.2	21.5
2006-07	15.7	11.1	11.6	6.0	3.6	24.4	2.3	2.7	10.8	34.3
2007-08	15.6	16.0	5.5	6.0	3.8	29.2	2.7	3.3	9.3	42.9
2008-09	13.4	10.9	8.4	5.6	3.1	25.7	2.4	2.5	7.6	42.9
2009-10	15.5	10.7	10.4	6.2	4.8	25.3	2.1	3.5	8.2	35.8
2010-11	16.8	10.7	6.9	6.1	6.5	27.3	4.2	3.5	7.1	46.1
TE 2010-11	15.2	10.8	8.6	5.9	4.8	26.1	2.9	3.2	7.7	41.6
CAGR (%) (2004-05 to 2010-11)	4.7	-0.2	-2.2	5.3	2.1	2.5	14.9	2.4	-8.6	13.6

Table 4: Cropping Pattern of Selected Households during 2012-13

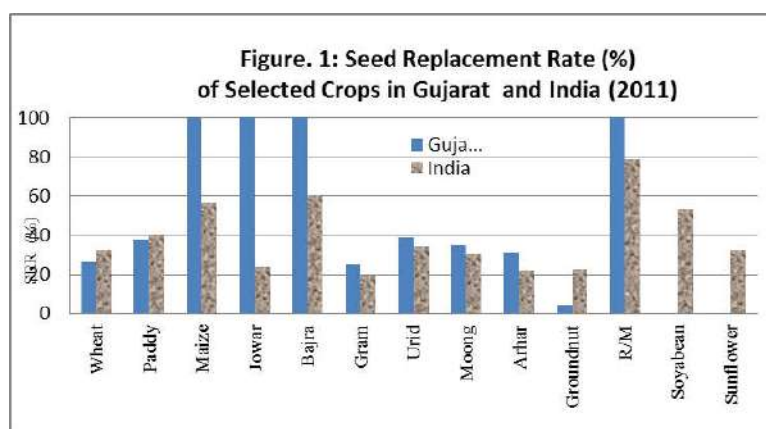
Sr. No	Crops	Cropping Pattern- Area in % to GCA					
		MF	SF	SMF	MDF	LF	All Farms
1	Paddy	8.41	8.29	8.46	8.78	8.40	8.58
2	Maize	2.80	1.95	2.31	1.88	2.70	2.48
3	Bajra	10.28	6.83	5.38	5.33	4.90	5.64
4	Jowar	0.93	0.98	1.79	1.57	1.90	1.58
5	Ragi	0.00	0.00	0.00	0.00	0.00	0.00
6	Wheat	12.15	11.71	11.79	11.60	10.10	11.06
7	Tur	1.87	2.44	2.56	1.72	2.10	2.03
8	Math	0.00	0.00	0.00	0.00	0.00	0.00
9	Udid	0.93	0.49	1.03	0.63	1.10	0.90
10	Gram	0.00	0.00	0.00	0.00	0.00	0.00
11	Groundnut	7.48	8.78	8.46	8.93	7.30	8.35
12	Sesamum	0.93	0.98	0.51	0.94	0.70	0.68
13	Soybean	0.00	0.49	0.51	0.47	0.70	0.45
14	Rapeseed- Mustard	2.80	2.93	2.82	2.35	1.90	2.26
15	Cator	1.87	4.39	4.87	4.55	5.60	4.74
16	Cotton	31.78	30.73	27.69	28.84	30.80	29.57
17	Sugarcane	1.87	0.98	2.05	1.72	2.50	2.03
18	Fruits and Veg	0.00	0.98	1.28	1.57	1.20	1.13
19	Spices	2.80	1.95	2.31	2.66	1.80	2.26
20	Other	13.08	15.12	16.15	16.46	16.30	16.25

Source: Field survey

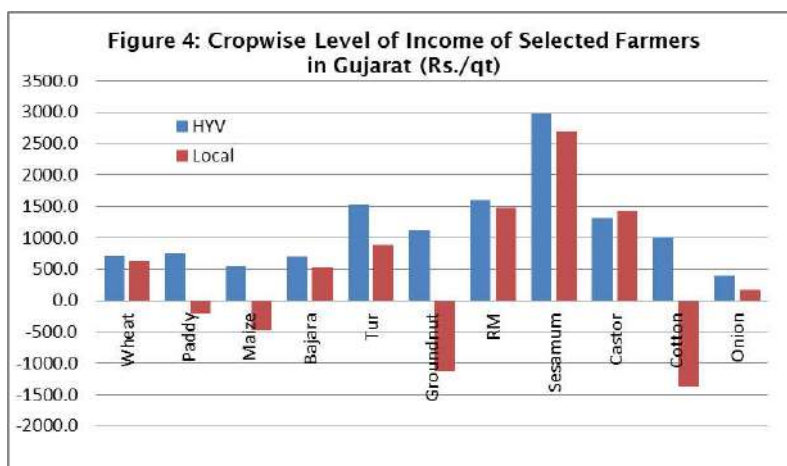
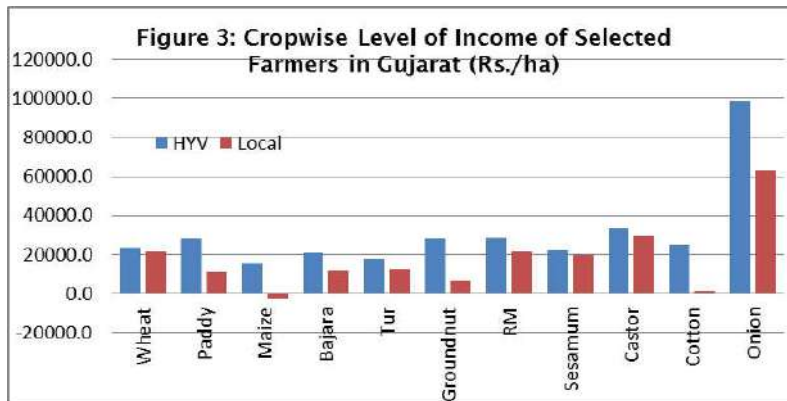
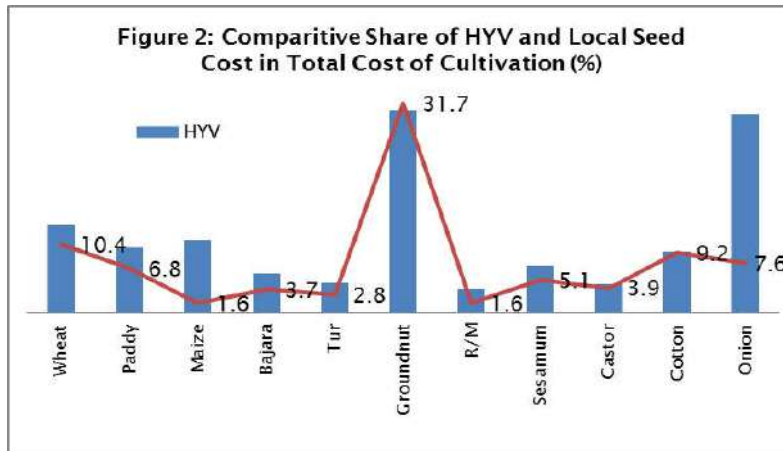
Table 5: Share of Seed Cost in Total Cost of Cultivation of Major Crops in Gujarat (%)

Sr. No.	Crop	Seed Cost (Rs/ha)	% share of seed cost in total cost
1	Wheat	3346.9	12.0
2	Paddy	2535.9	9.0
3	Maize	1445.9	6.0
4	Bajara	1282.9	6.0
5	Tur	578.5	3.6
6	Groundnut	10413.6	31.2
7	Rapeseed-Mustard	818.4	3.6
8	Sesamum	795.4	6.4
9	Castor	1131.2	4.4
10	Cotton	3096.7	9.3
11	Onion	7738.1	11.7

Source: Field survey



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Adoption of Recommended Doses of Fertilisers on Soil Test basis by Farmers in Gujarat[#]

Mrutyunjay Swain, S.S. Kalamkar and Kalpana Kapadia

Abstract

The study examines the level of adoption and constraints in application of recommended doses of fertilisers based on soil test (through Soil Health Card Scheme) by the farmers in Gujarat. The impacts of adoption of recommended doses of fertilisers on crop productivity, income and relevant institutional problems have been assessed. The two major crops (groundnut and cotton) were selected for the study. The study was conducted following a cluster approach on a sample of 160 control farmers and 240 soil test farmers. The study finds that level of adoption of recommended doses by soil test farmers was reasonably less (around 40 per cent for both groups). However, the adoption of recommended doses of fertiliser based on soil test has helped the farmers in increasing the agricultural productivity and income. The crop yield after soil tests has increased by 23.8% and 22.9% for groundnut and cotton respectively. The low adoption of recommended doses of fertilizers by the soil test farmers was due difficulty in understanding and applying recommended doses, lack of technical advice and high prices of fertilisers. The implementation of programme affected by focus on target achievement ignoring quality norms, inadequate staff strength, inadequate STLs and lack of trained personnel.

Key words: Soil Test, Soil health card, Recommended doses of fertilizer, Technology adoption

JEL: Q12, Q15, Q16

I. Introduction

Fertilisers have been considered as an essential input to Indian agriculture for increasing agricultural production so as to meet the food grains requirements of growing population of the country. It has been a well established fact that chemical fertilisers bear a direct relationship with food grains production along with a number of supporting factors like High Yielding Variety seeds (HYVs), irrigation, access to credit, tenurial conditions, size of the product market and the prices they face in input and output markets, etc. Various studies reveal a very close association between growth in use of fertilisers and crop productivity in the country (Randhawa, 1992; Kanwar 1997; Chand and Pandey, 2008). Therefore use of chemical fertiliser in India has tremendously grown since the advent of green revolution in late 1960s. The all-India average consumption of fertilizers has increased from 6.9 kg per ha of gross cropped area in 1966-67 to 125.39kg per ha in 2013-14 (GOI, 2014).

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The indiscriminate use of chemical fertilisers by farmers has led to deterioration of soil structure, wastage of nutrients, destruction of soil microorganisms and scorching of plants at the extreme cases. Based on 1.48 lakh soil samples from different agro-ecological zones (AEZ), Singh (2001) indicated the existence of 45, 8.3, 4.5, 3.3 and 33 per cent mean deficiency of Zinc (Zn), Iron (Fe), Manganese (Mn), Copper (Cu) and Boron (B), respectively in India. However, the level of deficiency varies widely among various AEZs. Prasad (2000) states that the mean percentage samples deficient in Zinc (Zn), Iron (Fe), Copper (Cu), Boron (B) and Manganese (Mn) in Gujarat was 24 per cent, 8 per cent, 5 per cent, 2 per cent and 1 per cent, respectively. There is a need to restore a balance in soil nutrients so as to maintain a good soil health.

The application of recommended doses of fertiliser, therefore, assumes prime importance. However, it is observed that the majority of farmers don't apply fertilizers on the soil tested plots as per the recommendations (Sevak, 1982). There are several factors that force the farmers not to adopt the recommended doses of fertiliser. Rastogi and Annamalai (1981) studied the adoption of recommended practices in dryland areas and found that shortage of capital and fear of losses were the main reasons for not adopting these practices. Among other factors, high prices of fertiliser, lack of knowledge about the recommended doses and their benefits, and non-availability of irrigation water and desired fertilisers were the major ones. Thus there is a need to generate more awareness among farmers through effective initiatives.

The Government of India has undertaken many initiatives to encourage the farmers for balanced use of fertilisers. These initiatives among others, included promotion of integrated nutrient management (INM), production and promotion of organic manures and bio-fertilisers, National Project on Management of Soil Health and Fertility (NPMSF) and nutrient based subsidy (NBS) policy. The Soil Health Card (SHC) Scheme was one such initiative launched at national level in February 2015. About 14 crore farmers have been targeted to be covered under the scheme in next three years (GOI, 2015). Among various states of India, Gujarat has been a leading state that implemented the SHC Scheme in much advance (since 2003-04). The state has covered about 53 lakh farmers by 2013-14. There have been efforts in other states to replicate the Gujarat Model of SHC implementation. However, there is no systematic study undertaken in the state so far for evaluating the effectiveness of the programme in promoting better soil health, raising crop productivity and farmers income. It is necessary to know the level of adoption of recommended doses of fertilizer based on soil tests done through SHC Scheme and its implications.

Therefore, the present study examines the level of adoption and constraints in the application of recommended doses of fertilisers by different categories of farmers in Gujarat, India. The study has also assessed the impacts of soil tests and adoption of recommended doses of fertilisers on crop productivity and income of the farmers.

II. Data and Methodology

The present study is based on both secondary and primary level data. The secondary data were published sources. The primary data were collected from the four selected districts of Gujarat covering the reference year 2013-14. The multistate sampling method was used to select the districts, blocks and farm households. The farmers who got their soil tested during the last three years were included for the detailed analysis. The household survey was administered on 400 farmers from 8 talukas of four districts. The selected districts of Gujarat were Surendranagar and Rajkot for cotton and Jamnagar and Junagadh for groundnut. The two major crops grown in the state (groundnut and cotton) were selected for the detailed study. For each study crop, the study was conducted following a cluster approach on a sample of 80 control farmers (no soil test) and 120 soil test farmers. Thus, the total sample size of the study for two selected crops was 400 (Table 1).

II. Progress in Soil Test and Distribution of SHC in Gujarat

Gujarat has made spectacular progress in soil testing and distribution of Soil Health Cards. The SHC programme was implemented in the state in two phases. During the first phase (2004-05 to 2011-12), 38.43 lakhs farmers (out of total of 46.61 lakhs in Gujarat) were provided Soil Health Cards (SHCs), covering about 85.5 per cent of total farmers in Gujarat. The Second phase was started from 2012-13, aiming to cover 25% farm holding (11.50 Lakh) every year. During last two years (2012-13 and 2013-14), about 15.26 lakh farmers have been provided the SHCs. Thus, since the inception, a total of 53.69 lakh soil health cards have been given to farmers by the end of 2013-14 (Table 2). The programme has generated alternative crop planning and recommendations for 229 talukas and 24324 villages and generated all Taluka and Village Model Action Plans (GoG, 2013). Along with increase in cumulative number of SHCs distributed to farmers from 2.27 lakh in 2004-05 to 53.69 lakh in 2013-14, the number of soil testing labs (STL) has also increased from 20 in 2004-05 to 134 in 2013-14 at the rate of 17.9 per cent per annum. Similarly, the annual soil sample analysing capacity has increased from 2.34 lakh in 2004-05 to 10.3 lakh in 2013-14. The actual soil sample analyzed has increased at the rate of 10.0 per cent per annum, i.e. from 3.23 lakh in 2004-05 to 7.64 lakh in 2013-14.

III. Socio-Economic Characteristics Of Sample Households

Among the sample farmers, the marginal and small farmers together constitute about 37.9 per cent of total soil test farmers and 31.9 per cent of total control farmers. Thus, the majority of the sample households are the medium and large farmers. The agriculture formed the main source of occupation for about 99.5 per cent of sample households. The average years of experience in farming was 26.8 years among soil test farmers and 23.5 years among control farmers. The average size of land holding was found to be 8.5 acres per soil test household, out of which 5.9 acres was irrigated and 2.6 acres was un-irrigated. In the case of control farmers, the average size of land holding was 8.95 acres per household, out of which 6.3 acres was irrigated and 2.65 acres was un-irrigated. The gross cropped area for soil test farmers and

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control farmers was 12.20 acres and 12.18 acres respectively. The cropping intensity for soil test farmers and control farmers was estimated to be 143.78 per cent and 136.03 per cent respectively. Thus, cropping intensity for soil test farmer was slightly higher than control group. The crop-wise data shows that the gross cropped area of cotton group of farmers was much higher (15.33 acre per HH) than the groundnut group of farmers (9.18 acre per HH). Therefore cropping intensity was much higher (149.5%) for the cotton farmers compared to groundnut farmers (129.2%).

The cotton growers were more mechanized as compared to groundnut growers. That to soil test farmers in cotton crop were more mechanized than control group farmers. The tractor with trolley, diesel engine, drip and sprinkler systems of irrigation was found higher with significant than its counterpart. However, in case of groundnut growers, except number of sprinkler and diesel engines, the control group farmers dominate the moderation of agriculture than soil test farmers. Thus, totally opposite situation of cotton grower could be seen in case of groundnut growers.

IV. Soil Testing and Recommended Doses of Fertilisers

The cost of soil test was nil for all soil test farmers since it was provided free of cost by the Government (Table 3). Some of the progressive farmers were also provided the detailed soil test analysis by the cooperatives. However, the average distance travelled to soil test lab (STL) by the groundnut farm households (129.3 km) was more than doubled the distance travelled by cotton farm households (49.4 km). Among groundnut farmers, the distance to STL was highest (151.9 km) for the medium farmers.

It is very surprising to note here is that about 40.8 per cent of cotton farmers and 36.7 per cent of groundnut farmers collected the soil samples by themselves. The collection of soil sample is scientific and systematic process which requires the training of same. Thus, the trained staff should have been collected the all soil sample to have correct results about soil health. The remaining around 60 per cent of total soil samples were taken by the department officials. The selected farmers opined that inadequate number of STLs has severely affected the quality of testing service provided to them by these agencies.

However, the farmers had shown keen interest in getting their soil tested for several reasons. The major motivating factors towards soil testing were to increase crop yield, adoption of new technological practices, motivation from village demonstration/training/exposure visits to places with best farming practices. Thus both group farmers got motivated with the information they received about the benefit of testing of soil in crop production. There are some farmers who had not tested their farm soil. It is because of the fact that spread of SHC programme was restricted and thus due to lack of awareness among the farmers, some farmers left out. Among non-soil test farmers, about 86.3 per cent farmers expressed that they are not aware about how to draw soil sample, about 79 per cent farmers mentioned that they do not know whom to contact for details on testing. Thus, lack of awareness, interest and low level of education has

kept away around 81 per cent sample control farmers from soil test.

The results of soil test indicted that average soil quality of farm plots of sample farmers was very poor in terms of nitrogen and phosphorus content. Only about 1.7 per cent farms of cotton growers and 2.8 per cent of groundnut growers were found to have normal nitrogen level. Only about 6.3 per cent of farm plots of cotton growers and 2.1 per cent of groundnut growers were found to have normal Phosphorus level. About 11.4 per cent farm plots of cotton growers and 14.9 per cent of groundnut growers were found to have normal level of potassium. The pH value was found to be normal in sufficient number of cases (90.8% for cotton and 100% for groundnut). The poor soil health has been mainly due to unbalanced use/doses of fertiliser application. Thus, it is necessary to adopt the recommended doses of fertiliser for maintaining better soil health.

The average quantities of recommended dose of fertilisers given based on soil test (as reported in the farmers' SHC) for the two study crops indicated that, for cotton, the major fertilisers recommended were Urea and FYM. The quantity of Urea recommended for HYV irrigated cotton, HYV unirrigated cotton and local cotton were 153.7kg/acre, 69.8kg/acre and 34.9kg/acre, respectively (Table 4). The FYM recommended for all types of cotton was 4.0 tonne/acre. In the case of Groundnut, the major fertilisers recommended were Urea, DAP and FYM. The average quantities of Urea, DAP and FYM recommended for summer groundnut were much higher than that for kharif groundnut. The average quantities of Urea, DAP and FYM recommended for summer groundnut were 7.0kg/ha, 37.1kg/acre and 4.0 tonne/acre, respectively. On the other hand, the average quantities of Urea, DAP and FYM recommended for kharif groundnut were only 3.5kg/acre, 17.6kg/acre and 4.0 tonne/acre, respectively.

V. Adoption of Recommended Doses of Fertilisers and its Constraints

The level of adoption of recommended doses by the soil test farmers was found to be around 40 per cent for both cotton and groundnut farmers (Table 5). Among the Cotton growers, the maximum adoptability was found in the case of small farmers (45.7%) and minimum adoptability was observed in the case of marginal farmers (28.6%). In contrast, in the case of groundnut crop, the maximum adoptability was found in the case of large farmers (45.0%) and minimum adoptability was observed in the case of small farmers (37.8%). Among soil test farmers, about 50.0 per cent of cotton farmers and 72.5 per cent of groundnut farmers have expressed their willingness to continue the same practices to maintain the better soil health and to get the better yields.

It worth mentioning that the average actual quantity of fertilisers applied by the soil test farmers was more close to the recommended doses compared to that by the control farmers. For example, the average recommended dose of Urea (the major fertiliser applied) for total cotton was 86.1 kg/acre. The soil test farmers growing cotton have applied about 83.1 kg/acre compared to 71.2 kg/acre by the control farmers (Table 6).

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In case of groundnut, use of DAP was the highest in both categories since this was the key fertiliser recommended for the crop (Table 7). The recommended dose of DAP for total groundnut was 27.1kg/acre. The quantity of DAP applied by the soil test farmers (29.9 kg/acre) was more close to the recommended dose compared to that applied by the control farmers (35.5 kg/acre). The control farmers of groundnut was found to apply excess quantity of DAP than the soil test farmers which is harmful to the overall health of soils.

The use of organic fertilizers by sample farmers indicates that as expected most of cotton as well as groundnut growers had used farm yard manure. About 84.2 per cent of soil test farmers and 93.8 per cent of control farmers applied FYM on their soil. Among groundnut farmers, about 80.8 per cent of soil test farmers and 85.0 per cent of control farmers applied FYM on their soil. The use of other organic fertilisers was found very meager in total in both the crops.

VI. Constraints in Application of Recommended Doses of Fertilisers (Soil Test Farmers)

The soil test farmers have faced several difficulties in applying the recommended doses of fertiliser as well. Among these constraints, difficulty in understanding and following application of recommended doses as stated in Soil Health Cards, unavailability of technical advice on method and time of fertiliser application, high prices of fertilisers and unavailability of required fertilisers in adequate quantity were the major ones (Table 8). In case of control farmers, around 66.7 per cent cotton farmers and around 58.3 per cent groundnut farmers mentioned that they are aware about the recommended doses. Around 65 per cent of farmers had received information on recommended doses of fertiliser from the officials of department of agriculture of the state. The other sources were fellow farmer and private input dealer. About one fourth cotton growers received information from fellow farmers whereas more than one fifth groundnut growers were advised by input dealers. Importantly in both crop growers, two third farmers had received information from authentic sources of state agriculture department since this was linked with a flagship programme like Krishi Mahotsav.

VII. Impacts of Adoption of Recommended Doses of Fertilisers

The adoption of recommended doses is believed to benefit the farmers in terms of improvement in yield, net returns and better soil health. The soil test farmers were found to realize better yield over the control farmers. The average yield of groundnut was found to be more in the case of soil test farmers by 13.3 per cent over control farmers (Table 9). Similarly, the soil test group of cotton farmers realized better average yield by 9.6 per cent compared to the control group. Thus, overall yield impact was better in case of groundnut farmers compared to cotton farmers. However, the increase in yield may not exclusively for adoption of recommended doses of fertiliser. It may be due to some other favorable factors like better seeds, better availability of irrigation water, among others.

As far as increase in average value of output per acre is concerned, cotton farmers

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recorded better increase, i.e., by about 25.4 per cent increase mainly because of the better price the realized; whereas the groundnut farmers have recorded an increase in average value of output by 13.5 per cent. Thus, overall returns on crop output realised was better in case of cotton farmers compared to groundnut farmers.

It would be important to see the impact of application of recommended doses of fertiliser on yield of particular crop, i.e. change in crop yield after application of recommended doses of fertilizers. It may be noted that, among the marginal cotton farmers, increase in yield level was lowest (9.3%) compared to other farmers (Table 10). However, among groundnut farmers, the marginal and small farmers had realized better yield level over other categories of farmers. They have realized about 20.4 per cent and 41.8 per cent increase in yield, respectively, after the adoption of recommended doses of fertiliser.

In addition to increase in crop yield, several other changes have been observed after the application of recommended doses of fertilisers on reference crops by the sample farmers. Improvement in soil texture, improvement in crop growth, improvement in grain filling, decrease in application of other inputs like seed, labour, pesticide etc. and fewer incidences of pest and diseases were the major benefits experienced by the sample farmers.

VIII. Policy Implications

The major impression which has emerged from the study is that the Soil Health Card (SHC) programme is an important and beneficial programme to the farmer. However, it was not implemented in proper manner in the State. In view to achieve the quantity targets fixed for some period/s, quality norms were not given proper attention which defeated the main purpose of the programme. In majority of cases, it was found that the SHCs were not with farmers. Those were kept together somewhere with some official/s. Thus, it was no use to the farmers. Depending on nutrient availability in soils, the recommended doses of fertiliser are expected to vary from region to region and from agro-climatic zone to zone. However, the same was not reflected in the SHCs provided to the farmers.

The qualitative improvements need to be made in implementation of SHC programme so as to improve the confidence of farmers on recommendations of SHC. It was observed that many farmers even failed to understand the content of the card. They failed to calculate the recommended doses of various fertilisers required for their pieces of lands. Thus, the information on SHC should be provided in simple format and understandable language and special Gram Sabha or training programmes should be organized to train/educate farmers or to raise the awareness level regarding importance of soil test, scientific method of collection of soil sample, how to read and understand SHC and what are the benefits of applying recommended doses of fertiliser.

The level of adoption of recommended doses by the soil test farmers was reasonably less due to various constraints, viz. difficulty in understanding and following application of

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recommended doses as stated in SHCs, unavailability of technical advice on method and time of fertiliser application, high prices of fertilisers and unavailability of required fertilisers in adequate quantity. Adequate efforts should be made to eliminate such constraints in order to increase the adoption level of recommended doses of fertilizers.

The inadequate number of Soil Testing Lab (STLs) and staff in implementation of scheme in the state has severely affected the quality of service provided to the farmers, as opined by the most of the sample farmers. The actual procedures followed for soil samples collection need to be monitored properly since it was found that near about 40 per cent of soil samples were collected by the farmers themselves which cannot be technically sound. Collection of Soil Samples may be organised in a particular village in campaign mode. All stakeholders [such as farmers, farmer friends (Gram Mitras), village level workers (VLWs), Block level officers fertilizer industries, Co-op Society, SAU students (as part of their internship of farmer's field / village for technical exposure), people representatives] should be brought to common platforms on some occasions so as to bring qualitative improvements and to raise the level of awareness in the villages.

Furthermore, it was reported that not only the selection of Gram Mitras was done properly but also they were not been imparted proper training to perform their duty accurately. Some of the farmers during discussion reported that samples had been collected from a single plot but had been shown for a large number of plots. Therefore collected soil samples need to be handled more carefully so as to ensure that farmer get his SHC for his plot/s only.

At present, different institutions such as Agriculture Department of the state government, Public Sector Undertakings (such as APMCs, Government supported Corporation Labs, Government supported Sugar cooperatives labs) and Science Colleges are involved in testing the soil samples and generating the soil health cards. Proper coordination among all these institutions is necessary for delivering reliable results and matching data sets. Collection of soil samples in the field, analysis of soil samples in the laboratory and delivery of SHC to the farmers must be performed in perfect harmony and entire process should be completed prior to sowing season.

One way to raise the level of confidence of the farmers is to demonstrate the usefulness of the recommendations by applying recommended doses of fertiliser on experimental plots at every village or at least at Gram Panchayat level. Adoption level of organic fertiliser and green manure was found to be very low among sample farmers. It is also necessary to reduce subsidy on chemical fertilisers and instead, subsidize more organic fertilisers so as to increase their adoption level.

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TABLE 1. DISTRICT-WISE DISTRIBUTION OF SAMPLE FARMERS

(Number of farmers)

Districts	MF	SF	MDF	LF	Total
Soil Test Farmers					
Surendranagar	3 (5.0)	7 (11.7)	17 (28.3)	33 (55.0)	60 (100.0)
Rajkot	4 (6.7)	20 (33.3)	24 (40.0)	12 (20.0)	60 (100.0)
Cotton total	7 (5.8)	27 (22.5)	41 (34.2)	45 (83.3)	120 (100.0)
Junagadh	8 (13.3)	27 (45.0)	17 (28.3)	8 (13.3)	60 (100.0)
Jamnagar	4 (6.7)	18 (30.0)	26 (43.3)	12 (20.0)	60 (100.0)
Groundnut total	12 (10.0)	45 (37.5)	43 (35.8)	20 (27.8)	120 (100.0)
Total (Soil Test)	19 (7.9)	72 (30.0)	84 (35.0)	65 (55.6)	240 (100.0)
Non-Soil Test Farmers					
Surendranagar	0 (0.0)	6 (15.0)	9 (22.5)	25.0 (62.5)	40 (100.0)
Rajkot	7 17.50	12 30.00	10 25.00	11.0 27.5	40 (100.0)
Cotton total	7 (8.8)	18 (22.5)	19 (23.8)	36 (123.1)	80 (100.0)
Junagadh	10 (25.0)	9 (22.5)	14 (35.0)	7.0 (17.5)	40 (100.0)
Jamnagar	1 (2.5)	6 (15.0)	14 (35.0)	19.0 (47.5)	40 (100.0)
Groundnut total	11 (13.8)	15 (18.8)	28 (35.0)	26 (54.4)	80 (100.0)
Total (Non-Soil Test)	18 (11.3)	33 (20.6)	47 (29.4)	62 (88.8)	160 (100.0)
Grand Total (Soil test+ Non soil test)	37 (9.3)	105 (26.3)	131 (32.8)	127 (31.8)	400 (100.0)

Notes: Figures in parentheses are the percentages of total; MF: Marginal farmers (0-2.5 acre); SF: Small farmers (2.5 – 5.0 acre); MDF: Medium farmers (5.0 – 10.0 acre); LF: Large farmers (>10.0 acre).

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TABLE 2. PROGRESS IN SOIL HEALTH CARD PROGRAMME IN GUJARAT, INDIA

Year	Soil Testing Laboratories under	Number of soil testing laboratories			Annual analyzing capacity	No. of sample analyzed	Capacity Utilized (%)	No. of dist. having STL	No. of SHCs made available to farmers	
		Static	Mobile	Total					During the year	Cumulative Total
1	2	3	4	5	6	7	8	9	10	11
2004-05	(i) State Government	16	4	20	184000	184893	100.5	18	227425	
	(ii) Public Sector Undertaking	3	1	4	50000	138089	276.2	0		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	19	5	24	234000	322982	138.0	18	227425	227425
2005-06	(i) State Government	16	4	20	184000	188596	102.5	18	492200	
	(ii) Public Sector Undertaking	3	1	4	60000	125583	209.3	0		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	19	5	24	244000	314179	128.8	18	492200	719625
2006-07	(i) State Government	18	2	20	190000	211691	111.4	18	249186	
	(ii) Public Sector Undertaking	3	1	4	50000	99677	199.4	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	311368	129.7	21	249186	968811

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Table 2 Continued...

1	2	3	4	5	6	7	8	9	10	11
2007-08	(i) State Government	18	2	20	190000	142692	75.1	18	219000	
	(ii) Public Sector Undertaking	3	1	4	50000	84789	169.6	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	227481	94.8	21	219000	1187811
2008-09	(i) State Government	18	2	20	190000	158224	83.3	18	568614	
	(ii) Public Sector Undertaking	3	1	4	50000	83819	167.6	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	3	24	240000	242043	100.9	21	568614	1756425
2009-10	(i) State Government	18	2	20	190000	307348	161.8	19	100000	
	(ii) Public Sector Undertaking	3		3	50000	104733	209.5	3		
	(iii) Private Sector						0.0			
	(iv) Total	21	2	23	240000	412081	171.7	22	100000	1856425
2010-11	(i) State Government	18	2	20	210000	650000	309.5	19	1279968	
	(ii) Public Sector Undertaking	70	0	70	1430223	1401646	98.0	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	88	2	90	1640223	2051646	125.1	26	1279968	3136393
2011-12	(i) State Government	20	2	22	220000	136408	62.0	21	706241	
	(ii) Public Sector Undertaking	81	0	81	810000	353625	43.7	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	101	2	103	1030000	490033	47.6	24	706241	3842634
2012-13	(i) State Government	20	2	22	220000	278931	126.8	21	900095	
	(ii) Public Sector Undertaking	81	0	81	810000	607421	75.0	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	101	2	103	1030000	886352	86.1	26	900095	4742729
2013-14	(i) State Government	20	2	22	220000	203725	92.6	21	626362	
	(ii) Public Sector Undertaking	112	0	112	810000	560099	69.1	24		
	(iii) Private Sector	0	0	0	0	0	0.0	0		
	(iv) Total	132	2	134	1030000	763824	74.2	26	626362	5369091
CAGR (2004-05 to 2013-14)	(i) State Government	2.5	-7.4	1.1	2.0	1.1	-0.9	1.7	11.9	
	(ii) Public Sector Undertaking	49.5	-100.0	44.8	36.3	16.8	-14.3			
	(iii) Private Sector									
	(iv) Total	24.0	-9.7	21.1	17.9	10.0	-6.7	4.2	11.9	42.1

Notes: *During 2010-11, other than 70 PSU, analysis work done in 55 science colleges to meet the Golden Goal 739431 samples were analysed by science colleges. Analysis work was outsourced to private agencies by State Government STLs to meet the Golden Goal and work was done in two shifts. Soil samples were analysed by Public Sector Undertakings such as APMCs, Govt. supported Corporation Labs, Govt supported Sugar cooperatives labs) and Science Colleges.

Source: Department of Agriculture, Government of Gujarat

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TABLE 3. DETAILS OF SOIL TESTING BY SAMPLE FARMERS

Particulars	Cotton	Groundnut
% of farmers tested their soil in the last three years	100.00	100.00
Average cost of soil testing (Rs/sample)	0.00	0.00
Average distance from field to soil testing lab (kms)	49.39	129.30
Average number of soil samples taken per plot	4.93	4.77
Average no. of plots considered for soil testing	1.27	1.14
Av area covered under soil test (Acre)	5.90	4.37
Area covered as % of net operated area	56.59	66.76
% of farmers who collected samples themselves	40.83	36.67
% of soil sample collected by the department officials	59.17	63.33

Source: Field survey

TABLE 4. AVERAGE QUANTITY OF RECOMMENDED DOSE OF FERTILISERS BASED ON SOIL TEST (AS REPORTED IN THE HEALTH CARD)-SOIL TEST FARMERS

Fertiliser	(Kg/acre)							
	Cotton				Groundnut			
	HYV Irrigated	HYV Unirrigated	Local Unirrigated	Total unirrigated cotton	Total Cotton (Average)	Kharif Groundnut	Summer Groundnut	Total Groundnut (Avg)
Urea	153.7	69.8	34.9	52.3	86.1	3.5	7.0	5.3
DAP	0.0	0.0	0.0	0.0	0.0	17.6	37.1	27.1
MOP	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FYM	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0

Source: Soil Health Cards of Sample Farmers (Field Survey)

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TABLE 5: APPLICATION OF RECOMMENDED DOSES OF FERTILISERS ON REFERENCE CROPS- SOIL TEST FARMERS

Particulars	Marginal	Small	Medium	Large	Total
	Cotton				
% of farmers applied recommended doses of fertilisers	28.6	45.7	35.8	42.2	40.0
Average area (acre)	1.8	2.4	3.0	6.4	4.1
Area covered as % of net operated area	14.7	5.6	7.0	16.6	3.5
Average number of seasons applied	2.0	2.0	2.0	2.0	2.0
% of farmers willing to continue applying recommended doses of fertilizers	42.9	55.6	36.6	60.0	50.0
Groundnut					
% of farmers applied recommended doses of fertilisers	41.7	37.8	40.3	45.0	40.3
Average area (acre)	1.1	2.4	5.2	8.2	4.3
Area covered as % of net operated area	38.4	19.6	42.2	187.8	13.8
Average number of seasons applied	1.0	1.0	1.0	1.0	1.0
% of farmers willing to continue applying recommended doses of fertilisers	66.7	73.3	72.1	75.0	72.5

Source: Field Survey

TABLE 6: ACTUAL QUANTITY OF FERTILISERS APPLIED BY THE SAMPLE FARMERS DURING THE REFERENCE YEAR (COTTON FARMERS)

Fertilisers	<i>(Kg/Acre)</i>				
	Marginal	Small	Medium	Large	Total
Soil Test Farmers					
Urea	75.8	103.2	101.4	55.6	83.1
DAP	41.9	35.5	31.2	25.8	30.8
MOP	2.8	7.2	9.9	1.6	5.8
SSP	7.1	2.2	5.4	0.0	2.8
NPK Mixture	0.0	1.2	11.0	1.5	4.6
Others	0.0	6.6	14.7	14.2	11.8
Control Farmers					
Urea	77.0	100.6	66.8	57.8	71.2
DAP	45.2	79.3	37.9	33.1	45.7
MOP	0.0	2.8	4.3	3.4	3.2
SSP	6.5	1.4	4.5	0.9	2.4
NPK Mixture	6.0	4.9	1.8	0.7	2.4
Others	3.6	0.1	0.1	1.2	0.9

Source: Field survey

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TABLE 7: ACTUAL QUANTITY OF FERTILISERS APPLIED BY THE SAMPLE FARMERS DURING THE REFERENCE YEAR (GROUNDNUT FARMERS)

Fertilisers	Marginal	Small	Medium	Large	Total
(Kg/Acre)					
Soil Test Farmers					
Urea	0.0	9.0	5.4	4.5	6.1
DAP	52.6	32.7	24.0	22.7	29.9
MOP	0.0	2.1	3.5	0.6	2.1
SSP	17.3	29.9	7.5	0.0	15.6
NPK Mixture	5.8	19.1	16.3	20.4	17.0
Others	6.3	7.8	2.1	1.5	4.6
Control Farmers					
Urea	58.5	22.5	13.4	6.5	19.1
DAP	56.2	39.6	36.9	23.0	35.5
MOP	5.7	0.0	0.4	7.2	3.3
SSP	6.5	10.8	8.2	5.8	7.7
NPK Mixture	0.0	4.1	3.6	6.0	4.0
Others	0.0	0.0	3.9	3.2	2.4

Source: Field survey

TABLE 8. CONSTRAINTS IN APPLYING RECOMMENDED DOSES OF FERTILISERS (% OF FARMERS)

Reasons	Cotton				Groundnut			
	Most Important	Important	Least Important	Total	Most Important	Important	Least Important	Total
Adequate quantity of fertilisers not available	3.3	7.5	3.3	14.2	9.2	4.2	2.5	15.8
Prices of fertilisers are high	3.3	6.7	3.3	13.3	5.0	8.3	1.7	15.0
Lack of money to purchase fertilisers	0.8	2.5	5.0	8.3	5.0	4.2	5.0	14.2
No technical advice on method and time of fertiliser application	10.8	2.5	2.5	15.8	10.8	5.0	0.0	15.8
Difficult to understand and follow the recommended doses	18.3	0.8	0.0	19.2	13.3	1.7	0.0	15.0
Any Other	2.5	0.0	0.0	2.5	2.5	0.0	0.0	2.5

Source: Field survey

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TABLE 9. PRODUCTIVITY OF THE SAMPLE CROPS DURING THE REFERENCE YEAR

Particulars	Average Yield (Quintal/Acre)			Average value of output (Rs/Acre)		
	Soil test Farmers	Control farmers	% difference in yield	Soil test Farmers	Control farmers	% difference in yield
Cotton						
Marginal	7.9	9.5	-16.4	38805.1	45355.0	-14.4
Small	10.0	8.6	15.9	49601.1	43251.7	14.7
Medium	8.6	8.0	7.5	40986.2	31361.1	30.7
Large	7.8	7.0	11.2	33458.4	23827.3	40.4
Total	8.6	7.8	9.6	39974.4	31870.7	25.4
Groundnut						
Marginal	8.8	4.3	103.3	28188.0	13555.9	107.9
Small	8.7	7.2	20.7	28630.2	23135.6	23.7
Medium	7.7	7.8	-2.2	23677.5	24762.8	-4.4
Large	8.1	8.0	2.2	25173.5	25384.4	-0.8
Total	8.2	7.3	13.3	26235.2	23118.8	13.5

Source: Field Survey

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TABLE 10. IMPACT OF APPLICATION OF RECOMMENDED DOSES OF FERTILIZERS ON CROP YIELD (SOIL TEST FARMERS)

Particulars	Average yield (Quintal/Acre)		% change in yield
	Before	After	
Cotton			
Marginal	7.3	7.9	9.3
Small	7.6	10.0	32.6
Medium	6.6	8.6	31.5
Large	6.6	7.8	18.3
Total	7.0	8.6	22.9
Groundnut			
Marginal	7.3	8.8	20.4
Small	6.1	8.7	41.8
Medium	6.6	7.7	15.4
Large	6.9	8.1	17.5
Total	6.7	8.2	23.8

Source: Field survey

Assessment of the Status of Dairying and Potential to Improve Socio-Economic status of the Milk Producers in Gujarat[#]

S. S. Kalamkar, H. Sharma and M. Makwana

Abstract

The present study was undertaken in Gujarat to assess present status and to identify the constraints in dairy development. The primary data were collected from the 240 sample farmers from four districts of Gujarat. It was observed that the plan investments made so far do not appear proportionate with its contribution and future potential for growth and development. The livestock services like artificial insemination/natural service, vaccination, de-worming, etc are time-sensitive and government institutions are not able to deliver in time due to financial as well as bureaucratic constraints. Shortage of quality fodder and feeds is another major constraint for livestock sector growth. The awareness about dairy schemes among selected households was very poor. The animal husbandry departments must be rejuvenated to act as drivers of growth for dairy sector. The role of institutions in dairy farming especially district dairy cooperatives need to be strengthened and there should be less bureaucratic and political interference in managing cooperative run dairies. The convergence of all state and central government schemes at the implementation level, in a given territory is necessary to bring improvement in milk production in a manner that will be sustainable, while ensuring social and economic improvements of the dairy farmers.

Keywords: Dairy Development, Cooperatives, Govt. Policies

JEL Classification: Q12, Q13, Q18

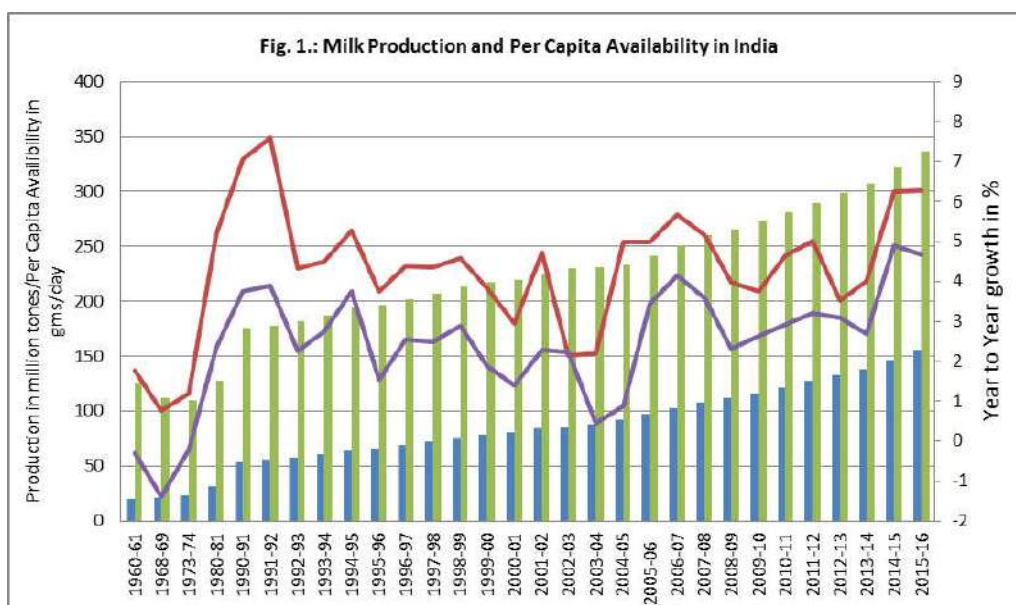
Introduction

Dairy development in India has been acclaimed as one of the most important and successful development programmes under the World's largest integrated dairy development programme 'Operation Flood'. India ranks first in the world in milk production, which has increased to 155.5 million tonnes in 2015-16 from 17 million tonnes in 1950-51 (Fig. 1). Nearly 51 per cent of milk production is contributed by buffalo followed by cow (45%) and goats (4%). Most of the milk is produced by animals reared by small, marginal farmers and landless labourers. It has been witnessed over the years that the stability in dairy income is far stronger than the income realised from agricultural activities. While more than 75 million households in India are

This is abridged version of research project carried out for Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of Gujarat, Gandhinagar.

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engaged in dairy farming, about 15.4 million farmers have been brought under the ambit of 1,60,000 village level dairy cooperative societies up to March 2014. The dairy co-operatives have made good impact on the social and economic life of the people in the state. The impact of the 'White Revolution' can be seen in the villages in the form of generation of funds for community development and social welfare, creation of self-employment opportunities, ensuring distributive justice and removal of the evil of untouchability. This silent social revolution has been relatively smooth and hence even unnoticed by the conservative community.



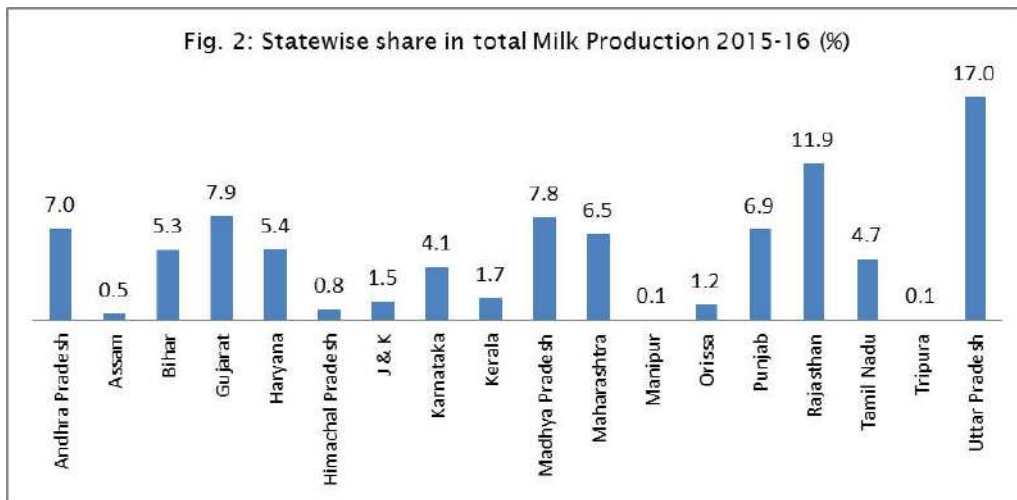
Despite of impressive growth in milk production during the past three decades, productivity of dairy animals continues to remain very low and milk marketing system is primitive (Rajendran and Mohanty, 2004; Sarkar and Ghosh, 2010). Currently, more than 80% of the milk produced in the country is marketed by the unorganised sector (private organisations) and less than 20% cent is marketed by the organised sector (government or cooperative societies). But, both organised and unorganised sectors in the dairy industry of the country face a lot of constraints. Therefore, present study was undertaken in the state of Gujarat to study the various types of constraints faced by the both cooperative and no cooperative dairy producers.

Data and Methodology:

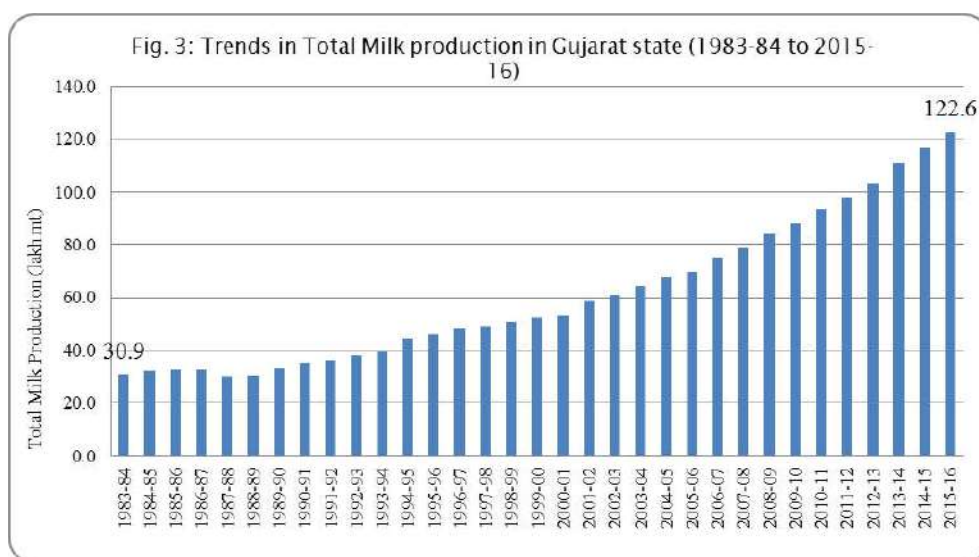
The study is based on both, secondary and primary level data. The secondary data were compiled from the offices of NDDB and from government publications. The primary data were collected from the selected 240 Milk producers from four milk unions of Gujarat, i.e., Mehsana (North Gujarat), Bharuch (South Gujarat), Junagadh (West Gujarat/Saurashtra) and Panchmahal (East Gujarat).

Dairy Development in Gujarat

Gujarat has been consistently clocking impressive agricultural growth rates and accounts for 7.9 per cent share to total milk production in our country (Fig. 2). This has been possible because the government has focused on improving not only irrigation, quality of seeds and power but also tertiary sectors like animal husbandry. The growth of the animal husbandry sector has resulted not only in increased milk production but has also provided a boost to the overall agroeconomy of the state. The cooperative sector has been the key driver of the tremendous increase in Gujarat's milk production during last three decades (Fig. 3). It is no surprise that Gujarat, the birthplace of India's white revolution, has a thriving milk cooperative sector. "Amul" pattern is well known and accepted by all the states in our country and some of the other countries also.



The institutions of national Importance such as National Dairy Development Board and National Cooperative Dairy Federation of India Limited are established and located in Anand district of Gujarat. Though the area coverage of these institutions is all India level, but it helped the Gujarat state is developing its dairy sector. Gujarat has total 18149 milk cooperative societies attached to 18 district level milk unions with 3.42 million milk producers (2015-16) contributing milk twice a day. Maahi Milk Producer Company Limited was incorporated on June 7, 2012, as a Producer Company under the provisions of Part-IXA of the Companies Act, 1956, in the State of Gujarat, to undertake the business of pooling, purchasing, processing of milk and milk products.



Findings from Field Survey:

Socio-Economic Profile of Selected Sample

The selected household average size was 5.8 members which was found almost similar in both categories (DCS- member of dairy cooperative society & NDCS- non member of dairy cooperative society). The average age of respondents of both categories was between 44-46 years, while most of the respondents were male. On an average respondent were educated up to 7th standard. Around three members from each family engaged in dairy activity. As dairy business is mostly deal by the females, it was expected that they would be the decision makers. However, field data indicate that about 90 per cent of decisions are taken by the male, while it was mentioned while data collection that female provide the support to the decision taken by the male, as per tradition followed in India everywhere.

The distribution of selected DCS households as per social group indicate the dominance of households belongs to other backward class (48 %), followed by General category (30%), Scheduled Tribe (18%) and remaining were from Scheduled Caste (3%). In case of NDCS households, 46 per cent households belong to other backward classes, 27 per cent were scheduled caste while remaining was scheduled tribe. The main occupation of the selected households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying. It was very surprising to note that very few households were engaged as agriculture labour or as a non farm labour. Thus, a number of dairy producers initially became involved in dairy farming as a secondary and supportive activity.

The selected DCS households possessed 1.8 ha operational land holding, of which 88.9 per cent was irrigated, while same was 1.9 ha in NDCS households with 84 per cent land under irrigation. The selected households in both the group has significant land under irrigation

and facility of protective irrigation to save crop in case of less rainfall during kharif or grow more crop during rabi and summer seasons. The DCS households were found more experienced (21.7 years) than NDCS household (19.6 years). Around one third of selected households were below poverty line as per income group category indicates relatively better economic condition of two third households.

Out of total gross cropped area, around 53-55% area was sown in kharif season, around 36% was sown in rabi season and remaining in summer season. Groundnut, cotton, soybean, maize, tur and moog were the dominant kharif crops, while wheat and gram were important crops grown in Rabi season while during summer, bajra and groundnut crops were grown. Besides, significant area was allotted to fodder crops as well, due to requirement of fodder for dairy animals.

Size of Herd & Awareness about the Schemes

All together, every DCS households has the highest share of buffaloes, followed by local cows and then cross bred cows in total heard strength. Out of total heard strength with DCS household, around 55 per cent animals were milch animals, the highest share was of cross breed (78.6%), followed by buffaloes (58.6%) and cows (52.5 %). In case of NDCS households, the dominance of buffaloes can be seen in total heard strength with households, while share of local and cross crossbreed cows was lower than DCS households. In case of share of milch animals to total animal in each species, it was highest in case of buffaloes (61.7%), followed by cross breed cows (56.8%), and local cows (53.6%). At overall level, both the groups (DCS & NDCS) have almost similar herd strength. However, in both cases, the milk yield of cross breed cows was the highest followed by buffaloes and local cows.

Some of the DCS households have covered their few animals under animal insurance program, wherein government has paid some amount and dairy producer has deposited his share. The coverage of animals under insurance was relatively better in case of cross bred cows, while same was meagre in buffaloes and almost nil in local cows. In fact in case of NDCS households, no animal was covered under insurance. It indicates that government should make necessary policy and arrange extension activities to increase the awareness among the dairy producers to cover their animals under insurance scheme. On an average the premium paid per animal ranges between Rs 1500-2500/-. Across the seasons, the milk yield was higher during winter season followed by rainy season and the lowest was in summer. Overall large milk producer group dominates the milk yield in all species irrespective of members of DCS or not.

Except few exceptions, in all species and across size groups, the quantity of feed (dry and green fodder) and concentrates was found higher in case of NDCS households, while in case of supplements, except one case, DCS households have feeded more quantity than NDCS households. The selected households used self cultivated as well as purchased fodder. The animals were also feeded with concentrates which were mostly purchased from the market. Besides feeding the animals at stall in shed, the selected households in Surat could graze their

animals every day for about 6-8 hours on their own agriculture land or common grazing land of the village. Beside feed and fodder, availability of quality of water also determines growth of dairy activities. Groundwater was the main source of water followed by village talawadi and open well in the village.

It was observed that on an average, about three fourth of DCS households were aware about different vaccinations schemes/programmes, while in case of NDCS households, awareness about same was very poor (41.7 %). In case of artificial insemination programmes, about 71 per cent DCS households had information while hardly 42 per cent NDCS households were about same. Around 64 percent DCS households were aware about other dairy development programmes, while NDCS households were almost unawareness about same.

Cost of Milk Production

The net returns realised by the DCS households was higher than NDCS households all groups and in all species. On an average, net return of about Rs. 32/- was realised by the DCS households as compared to Rs. 14/- realised by the NDCS households. The net return realised by the DCS households was higher by 130 per cent at overall level. The highest net return by DCS households was recorded in case of crossbred cows, followed by local cows and lowest was in case of buffaloes. However, in case of NDCS households, the highest net return per animal was recorded in local cows, followed by cross breed cows and lowest was in buffaloes. Low margins for NDCS dairy producers may be due to low milk productivity from animals with low genetic potential, poor health, feeding and husbandry practises low price offered by private agent/agency. Therefore, there is a huge scope to enhance producers' income from dairy by enhancing animals productivity, improving management practise, and ensuing remunerative prices.

Milk Consumption & Marketable Surplus

The data indicate that the small milk producers generally consume larger proportion of milk produced followed by medium milk producer and the lowest was in case of large milk producers. In fact, across the species, households preferred to consume and process the milk of local cows (20.1%), followed by buffaloes (13.1%) and cross breed cows (7.3 %). Thus the buffalo and cross breed cow milk was sold outside and local cow milk was mostly consumed at the home. In case of NDCS households, though the use of local cow milk was relatively better but was at par with the cross breed cows and marginally higher than buffalo cows.

On an average, except in case of local cow milk use by small milk producers, more than 70 percent of milk produced had been disposed by the selected households of both groups. The range of milk sale was found to be 70-93 per cent of total. However, across the milch animal holding group, there are variations. Small milk producers have used more share of milk for the home purpose and used for preparation of further value added products, such as ghee, curd, etc. If we look at the disposal pattern of milk, it can be observed that all the DCS households had sold milk to dairy cooperative societies, where they got weekly payment. Few households

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from large milk producer group had sold small quantum of milk to consumers on month payment basis. The distance of dairy societies was quite closer and thus very meagre cost was incurred on transportation. The milk rate realised by the milk producer was around 25-27 in case of cow milk and around Rs. 39 in case of buffalo milk.

The opposite picture was seen in case of sale of milk by the NDCS households. NDCS households opted to sale their milk to private milk plant which was maximum 6 kms away from the households for which they incurred around Rs. 6-14 cost as transportation cost. The payment was provided as per requirement and milk rate realised was around same as in case of DCS members. Few of NDCS members had sold the milk to private vendor/shop/middlemen as well as to catering services. Thus, it is clear that unlike of almost 100% sale to dairy cooperative society by DCS households, NDCS households had to sale to variety of customers, where in rates are relatively lower and other facilities may not have available as like in dairy cooperatives. Thus, in case of NDCS households, marketing channels remains traditions and more than 89 per cent of marketable surplus in milk is sold through informal channels, especially private traders in unorganised sector and direct sale to consumer. This is in sharp contrast to sale of milk by DCS households to dairy cooperatives.

Constraints faced in Production and Marketing of Milk and Suggestions

DCS households recorded the adequate supply of cattle feed which was also made available on credit by cooperative society, however most of households mentioned that cost of cattle feed and miner mixtures was high. Though the emergency veterinary services were available, the EVS charges of dairy cooperative were medium as compared to high charges by private agents. Not only the availability of vaccines and semen at the AI centre at dairy cooperatives as well as at private dairy agents was inadequate but also the delivery & applications of quality & requisite quantity of vaccines was very poor. It was observed that there was no provision of loan in society or government for the purchase of cattle and no technical guidance was available to them. Most of the households mentioned that premium for insurance was medium, however, very few dairy producer had taken animal insurance.

In case of output delivery, DCS households mentioned that the milk price received by them was adequate and they get fortnightly payment. Two third of households mentioned that incentives or bonus for supplying milk were adequate, while one fourth of selected households mentioned that cross bred cow milk is not acceptable in family. Dairy cooperatives do not have system of advance payment for milk while agent or private agency has provided this facility in selected area.

In case of NDCS households, these households did not have facility to get any support from the dairy cooperatives existing in their area, they are fully depend on the agent or private agency to get support for input and output service systems. Though the supply of cattle feed and fodder was adequate with agents and private agency, which was available on credit for half of the households. Almost three fourth of households mentioned about non availability of emergency

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veterinary services and whatever is available was availed at very high charges. The poor availability of vaccines and semen was also noted by NDCS households. More than 90 per cent of households mentioned that charges for premium are very high and no technical support is available to them. As expected, three fourth of selected NDCS households mentioned that milk price received by them are low. The two third of households received payment after 15 days while one third received within 15 days time after sale of milk. Almost all the selected households mentioned about no incentives or bonus for supplying milk and no advance payment was provided by vendors/private agency. Three fourth of selected households mentioned about non acceptability of cross bred cows milk in home consumption.

The four major infrastructural constraints faced by the selected DCS household were unavailability of emergency veterinary services, infrequent visit of veterinary staff, unavailability of cattle feed and fodder seed on credit, and low average milk yield of the milk animals, while NDCS households faced constrains such as infrequent visit of veterinary staff, lack of training facilities, unavailability of emergency veterinary services and lack of improved equipments.

The four major economic constraints faced were low price of milk offered, high cost of fodder seed, high cost of cattle feed and miner mixtures and high charges of emergency veterinary services. The underlying causes behind the major economic constraints faced by NDCS were high cost of veterinary services, high charges of emergency veterinary services, high cost of cattle feed and mineral mixtures, low price of milk offered, high cost of fodder seed, low provision of loan in society or government for purchasing of cattle and low incentives or bonus for supplying milk and high charges for insurance.

The major economic constraints faced by the selected household were less knowledge about marketing strategies and low risk taking behaviour were constraints faced by DCS households while NDCS households had faced four marketing constraints viz., less knowledge about marketing strategies, no or less advance payment for milk by society/vendors, lack of time for marketing and low risk taking behaviour.

The two main marketing constraints faced by the DCS households were less knowledge about marketing strategies and low risk taking behaviour. The NDCS households has faced four marketing constraints viz., less knowledge about marketing strategies, no or less advance payment for milk by society/vendors, lack of time for marketing and low risk taking behaviour.

The two main socio-psychological constraints reported by DCS as well as NDCS households were lack of purchasing power and lower socio-economic conditions. Lack of time due to busy in domestic/agricultural work was another problems faced by them.

The common constraints faced by the both households were poor knowledge about scientific animal husbandry practises and dairy farming, poor livestock extension services, lack of awareness about quality of milk, lack of veterinary services in village for quality milk production, and poor housing to milch animals. Besides these constraints, NDCS households faced constraints

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such as lack of marketing facility for dairy business, unavailability of chilling facilities at village level for milk preservation, unavailability of medicine and equipments required for quality milk production.

About 48 per cent of DCS households have suggested that veterinary literature should be provided in village, 46 per cent households mentioned that marketing facilities should be provided at village level for the outlet of milk and milk product, while about 41 per cent households suggested that loan sanction procedure should be made easy. Besides, other suggestions were loan amount for the purchase of dairy animals need to be increased; need to improve service deliver, enhance the milk price for producers, and technical knowledge for management of dairy enterprise. The main suggestions made by NDCS households were need to marketing facilities at village level for sale of milk and milk products, improvement in service delivery, need of veterinary literature at village level and need to make easy process of loan sanction.

Conclusions and Recommendations

- The major constraint in milk marketing is the involvement of the unorganized sector. Changing the dairy-cooperative laws and regulations can reduce the unorganized sector's role in milk marketing. Strengthening the infrastructure for milk collection, transportation, processing, packaging, pricing, and marketing through dairy co-operatives can also change the minds of the milk producers.
- Shortage of quality fodder and feeds is another major constraint for livestock sector growth. Therefore, there is a need to work out the strategies for sufficient good quality feed and fodder for efficient utilisation of genetic potential; of the various livestock species and for sustainable improvement in productivity.
- The awareness about the dairy schemes among selected households was very poor. Therefore, there is a need to increase use advanced technology such as mobile phones in dairying for effective dissemination of livestock related information in general and dairying in particular.
- The selected households seldom aware about the livestock insurance. As insurance of livestock is the best safeguard for minimising the risk especially small holder producers, there is a need to increase the awareness and mandatory provision of the companies to undertaken livestock insurance of interested milk producers.
- Though livestock health situation in India is improving, Foot and Mouth Disease remains the issue of concern. There is a serious need for protection of animals against diseases and parasite which is one of the pre-requisites for sustainable livestock production and milk production.
- The four major infrastructural constraints faced by selected households were unavailability of emergency veterinary services, infrequent visit of veterinary staff, unavailability of cattle feed and fodder seed on credit, and low average milk yield of the milk animals.

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- Non availability of veterinary services at the village level in time is the major constraints. The animal husbandry departments must be rejuvenated to act as drivers of growth for dairy sector.
- Given the fact that stress due to climate variability and availability of feed will be increasing constraints, more emphasis is required in promoting indigenous breeds. The data on animal genetic resources need to be generated and preserved properly for future use.
- The role of institutions in dairy farming especially district dairy cooperatives need to be strengthened and there should be less bureaucratic and political interference in managing cooperative run dairies in India.
- The environmental security and sustainability must be made integral measures taken in the Indian dairy sector in arena of increase in milk production, storage, value addition, improving the genetics of local breed and reducing the risk in operation.
- The co-operative structure is very weak in Saurashtra and Kachchh regions of the state. Therefore, there is a need to support the presence of Milk Producer Company in all the areas for balanced development of dairy sector.

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Impact Assessment and Evaluation of Ration Balancing Program (NDP-I) in Gujarat¹

S. S. Kalamkar, H. Sharma and V. K. Boyal

Abstract

The present study was undertaken in Gujarat to evaluate the efficacy of Ration Balancing Program (under National Dairy Plan I) in increasing milk yield and/or reducing feed cost. The study is based on secondary and primary level data. The primary data were collected from sample of 200 beneficiaries, 200 non-beneficiaries and 20 LRPs from 20 selected villages of two districts unions (Banaskantha & Surat) of Gujarat. It was observed that more than 92 percent of beneficiaries were aware about RBP. The success of RBP can be seen from the fact that more than 88 percent of farmers were following the recommended ration advisory given by LRP, while more than 80 percent households felt that they are in programme. Around 78 per cent beneficiary households opined that milk production has increased (by 15%) i.e. 1.5 litre/day. More than 79 per cent households realized that milk fat and SNF level has also increased. The health of animals is also reported improved after adoption of RBP. Decrease in digestive disorders of animals after adoption of RBP was also experienced. More than half of the selected households have realized reduction in feed cost.

Keywords: Ration Balance and Dairy Development, Government Policies.

JEL Classification: Q12, Q18.

I. Introduction

Dairying plays most vital role in providing employment and income generating opportunities for millions of rural families in our country particularly for women and marginal farmers. Though India stands at first position in world in terms of population of cattle and buffalo as well as milk production, productivity of dairy animals is very low, which may be due inappropriate feeding as well as inadequate supplies of quality feeds and fodder along with low genetic profile of breeds. However, achieving higher productivity by increasing its genetic potential is not possible therefore due attention is needed to be given on proper feeding of milch animal. Imbalanced feeding not only adversely affect health and productivity of animals but also income from milk production, as more than two third of total cost of milk production is accounted by feed. Therefore, there is a need to educate milk producers on balanced feed to their animals so

* This is abridged version of research project carried out for NDRI, Karnal (project sponsored by NDDB, Anand).

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that nutrients required by each milch animal is fulfilled in an optimum manner which would improve the milk production efficiency and economic return.

With an aim to increase productivity of milch animals, Union Government had approved National Dairy Plan Phase I (NDP I) as a Central Sector Scheme for a period of 6 years from 2011-12 to 2016-17 (covering 14 major milk producing States viz. Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal) which is extended to three more states (viz. Uttarakhand, Jharkhand and Chhattisgarh) and up to 2018-19. This plan is implemented wholly by National Dairy Development Board, Anand (Gujarat) through milk co-operatives and state agencies. The project includes a number of programs, of which Ration Balancing Program (RBP) is one of them which is designed with an aim to provide advisory on balance ration to dairy owner in order to improve milk yield of milch animals, reduce feeding costs/kg of milk produced and reduction in methane emission/kg of milk produced by animals. It is expected that through this programme, about 40000 LRPs would be trained to provide ration balancing advisory services for about 2.7 million milch animals in 40000 villages.

Gujarat is one of the leading states in India in terms of quality milch animals and milk production, having elite breeds of livestock like Girand, Kankrej, Mehsani, Surti, Jafarabadi and Banni buffalows, which have high milk yields. Gujarat accounts for about 7.99 per cent of total milk production in our country and ranks third position (116.91 lakh tonnes) during the year 2014-15. It is now four years since RBP is being implemented in the State of Gujarat and there is a need to access the performance of the scheme at ground level. Therefore present study was undertaken in the state of Gujarat to evaluate the efficacy of RBP in increasing milk yield and/or reducing feed cost

II. Data and Methodology:

The study is based on both secondary and primary level data. The secondary data were compiled from the published sources. The primary data were collected from the sample dairy farmers. The programme has been implemented in 4 EIAs of Gujarat (Surat, Mehsana, Sabarkantha and Banaskantha) of which two EIA were selected, namely Surat and Banaskantha by keeping in view the diversity of livestock animal and agro-climatic conditions. Total 10 villages under each EIA were selected randomly out of the villages where RBP is being implemented. A sample of 10 beneficiary dairy farmers and 10 non-beneficiary dairy farmers from each village were selected randomly. The LRP operating in each of the selected villages were interviewed. Thus, data were collected from 200 beneficiaries, 200 non-beneficiaries and 20 LRPs from 20 selected villages from two districts unions of Gujarat.

III. NDDDB's RBP:

The estimation of requirement of nutrient for an animal depends on various factors like type, class and age of animal, pregnancy status, body weight, milk fat and yield, calving

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month, etc. In order to assess the nutrients supply, information on nutrients availability from the feeds and fodder being fed is required and then on the basis of nutrient requirement and availability of feed resources, a least cost animal ration is formulated. As formulation is a multifaceted exercise and is very difficult to work out manually and therefore NDDB has developed the software (Information Network for Animal Productivity and Health) which formulates least-cost balanced ration. The objective is to produce an optimum quantity of milk at the least-cost combination of locally available dietary feed ingredients. NDDB developed user-friendly software is used by dedicated local resource persons (LRPs) trained by the implementing agency to effectively use the software in the local language and involves the assessment of nutrient status of animals; chemical composition of locally available feed resources; nutrient requirement of animals; and then formulating least-cost balanced ration using locally available resources. The LRP re-visits the milk producer according to his/her requirement and keeps a record of the various observations related to the quality and quantity of milk, including the cost of milk production before and after implementation of the RBP and increase in the net daily income per animal. For this purpose, necessary facilities such as a personal digital assistant/ netbook loaded with NDDB's RBP software, a weighing balance, measuring tape and ear tags with applicators, is provided to LRP.

IV. About Selected Milk Union

Surat EIA cover 1500 villages and 1128 primary cooperative milk societies spread over two districts. Banaskantha EIA covers relatively less number of villages (1409) but more number of milk societies (1250) compared to Surat (Table 1). The annual collection of Banaskantha dairy was around 11724 lakh liters while same was around 3903 lakh litres in Surat. The dominance of milch cows was found in Surat while large numbers of milch buffaloes were recorded in Banaskantha. The official inception of RBP in Banaskantha was in July 2012 while it was in February 2013 in Surat. Both the unions are yet to achieve the target fixed (Table 2).

Table 1: Basic information about EIA

Sr. No.	Particulars	Surat	Banaskantha
1	Milk Union (name)	Surat Milk Union	Banaskantha Milk Union
2	Districts Covered (no.)	02 (Surat & Tapi)	01 (Banaskantha)
3	Total number of Villages Covered	1500	1409
4	Total Number of village level Dairy Cooperative Societies	1128	1250
5	Milch Animals (no.)	LC:245789 CB:412578 BU:215364	LC:144656 CB:241964 BU:1068227
6.	Annual Milk Procurement (lakh litres)	3903.2	11723.8

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Sr. No.	Particulars	Surat		Banaskantha	
A	Date of official inception of RBP	February 2013		July 2012	
B	Target and Achievements	Target	Achievement	Target	Achievement
1	Staff Position- at Union level	6	6	13	9
2	Net-books purchased (no.)	420	420	420	420
3	LRPs trained (no.)	400	382	400	367
5	LRPs functioning (no.)	400	313	400	349
5	VAP Conducted (no.)	1000	104	1000	1001
6	Villages covered (no.)	400	318	400	311
7	Animals Covered (no.)	40000	28841	40000	31694
Source: Data provided by respective milk union.					

V. About Sample Households

Average size of selected household was around 5.5 members which was similar in both categories (BEN-beneficiary & NBEN-non-beneficiary households), while household size was relatively larger in Banaskantha as compared to Surat. The average age of respondents of both categories was around 43 years. The higher rate of literacy was found in beneficiary households (77%) than non-beneficiary households (70.8%). As Surat is a well developed district, the level of education was found relatively higher in the selected households than selected households in Banaskantha. All the selected households belongs to Hindu religion, of which dominance of scheduled tribe population was observed in Surat district while majority of belongs to other backward class category in Banaskantha district. The main occupation of households was agriculture comprised of cultivation of land as a farmer along with supportive allied activity of animal husbandry and dairying.

The selected households in Surat has very small piece of land of 4-5 bigha while same figures for Banaskantha was 12-13 bigha, having more than 85 percent land under irrigation. In fact irrigated area share in total area was found higher in Surat (around 95%) than Banaskantha (87.2 %). Higher size of land holding with irrigation support may have resulted in high level of income in Banaskantha as around 80 percent of households are categorized above poverty line as compared to around 57 per cent in Surat. The tribal population dominance in some pockets of Surat are reflected in relatively large number of households under below poverty line. The local resource person (LRP) had regularly visited 68 percent households in Surat and 78 percent households in Banaskantha while 32 and 46 percent households respectively received regular support of Veterinary assistant surgeons. The non-beneficiary households had also received same extent of support of veterinary assistant surgeon and from LRP as well.

The frequency of mass media exposures through television and educational film was relatively low and majority of the selected households had not received magazine, newspaper

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and pamphlets. The cropping pattern details shows that sample households from Surat had highest area under sugarcane crop followed by cereals and fodder crop. While farmers of Banaskantha district had grown more oilseed crops in kharif, followed by fodder crops, cereal and pulses. The beneficiary households had put relatively more area under fodder crops than non-beneficiary households.

Table 3: Socio-Economic Characteristics of Selected Households

Sr. No.	Particulars	Surat		Banaskantha		Gujarat	
		BEN	NBEN	BEN	NBEN	BEN	NBEN
		n=100	n=100	n=100	n=100	n=200	n=200
1	Av. Household Size (Nos.)	5.1	5.2	5.8	5.8	5.5	5.5
	<i>Male (%)</i>	39.7	39.5	35.4	37.1	37.4	38.3
	<i>Female (%)</i>	39.1	40.8	34.0	32.8	36.4	36.6
	<i>Children (below 15 years)%</i>	21.1	19.7	30.6	30.1	26.2	25.1
2	Av. Age of Respondent (years)	42.8	42.6	39.6	37.7	41.2	40.1
3	Av. Age of Family (years)	32.2	33.3	27.1	27.7	29.7	30.5
4	Experience in dairy (years)	22.5	22.2	26.3	27.9	24.4	25.1
5	Level of Education of Family (%)						
	<i>Illiterate</i>	19.8	24.7	25.6	30.6	22.9	27.8
	<i>Literate Without Formal Schooling</i>	0.2	1.2	0.0	1.3	0.1	1.3
	<i>Primary</i>	17.5	7.8	17.3	16.4	17.4	12.3
	<i>Middle</i>	17.5	17.6	24.0	21.8	21.0	19.8
	<i>Secondary</i>	21.3	21.4	14.4	17.0	17.6	19.1
	<i>Higher Secondary</i>	11.5	13.3	10.5	8.6	11.0	10.8
	<i>Diploma/Certificate Course</i>	1.7	1.2	0.7	0.4	1.2	0.8
	<i>Graduate</i>	7.9	10.6	6.5	3.9	7.1	7.1
<i>Post Graduate And Above</i>	2.5	2.2	0.9	0.0	1.7	1.1	
6	Religion (% to total)						
	<i>Hinduism</i>	100.0	100.0	100.0	100.0	100.0	100.0
	<i>Islam/ Christianity/ Sikhism</i>	0.0	0.0	0.0	0.0	0.0	0.0
7	Social Group (% to total)						
	<i>Scheduled Tribe</i>	83.0	77.0	15.0	13.0	49.0	45.0
	<i>Scheduled Caste</i>	7.0	6.0	5.0	1.0	6.0	3.5
	<i>Other Backward Class</i>	7.0	15.0	68.0	76.0	37.5	45.5
	<i>General</i>	3.0	2.0	12.0	10.0	7.5	6.0
8	Occupation -Main (% to total)						
	<i>Cultivator</i>	55.0	54.0	50.0	54.0	52.5	54.0
	<i>AH & Dairying</i>	41.0	39.0	47.0	45.0	44.0	42.0
	<i>Agri. Labour</i>	1.0	1.0	0.0	1.0	0.5	1.0
	<i>Trade</i>	0.0	0.0	2.0	0.0	1.0	0.0
	<i>Employee In Service</i>	3.0	5.0	1.0	0.0	2.0	2.5
	<i>Other (Specify)</i>	0.0	1.0	0.0	0.0	0.0	0.5
9	Operational Land Holding (Bigha)						
	Irrigated	4.20	4.78	11.94	11.71	8.07	8.25
	% to total	96.4	93.8	85.2	89.2	87.9	90.5
	Unirrigated	0.16	0.32	2.07	1.42	1.11	0.87
	% to total	3.6	6.2	14.8	10.8	12.1	9.5
	Total	4.36	5.10	14.01	13.13	9.18	9.11
10	Income Group (% to total)						
	BPL	43.0	44.0	17.0	23.0	30.0	33.5
	APL	57.0	56.0	83.0	77.0	70.0	66.5

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	If APL, Annual Income (% of hh)						
	Below 1 lakh	18.0	16.0	10.0	9.0	14.0	12.5
	1 to 3 lakh	25.0	17.0	23.0	22.0	24.0	19.5
	3 to 5 lakh	11.0	16.0	32.0	22.0	21.5	19.0
	above 5 lakh	3.0	7.0	18.0	24.0	10.5	15.5
11	Dwelling Structure (% to total)						
	<i>Pucca</i>	29.0	32.0	67.0	55.0	48.0	43.5
	<i>Semi-pucca</i>	27.0	23.0	26.0	30.0	26.5	26.5
	<i>Kuccha</i>	44.0	45.0	7.0	15.0	25.5	30.0

VI. Local Resource Persons (LRP)

The male LRP dominance can be seen in selected villages of Banaskantha than Surat district. The average age of LRP ranges between 22-29 years and half of them were married. As most of the area selected for the study in Surat district union fall in hilly area and categorized as tribal area, all the LRP belongs to scheduled tribe caste, while dominance of LRP belonging to Other Backward Classes category was found in Banaskantha milk union area. Though the selected LRP receive fixed salary, most of them earn incentives on sale of other product as well as through other assignments.

VII Findings from Field Survey

7.1 Livestock holdings/Herd Strength

- All together, numbers of cattle covered under RBP were higher than buffaloes in selected areas of both districts. However, among the cattle, crossbred cattle dominated the numbers. At overall level, except number of buffaloes in Surat, beneficiary households had higher herd strength than non-beneficiary households in both districts.
- Total 114 cattle and 33 buffaloes of selected households of Surat were covered under RBP while corresponding figure for selected households in Banaskantha were 224 and 180 respectively. As per the RBP guidelines, in-milk cow and buffaloes are preferred first to select under programme followed by adult female cattle and buffaloes and heifers, the data confirmed the coverage of animals as per guidelines stipulated.

7.2 Breedable Animals

- The average age of first calving ranges from 32-39 months in case of cows and 40-47 months in case of buffaloes.
- In case of beneficiary households, except local cow yield in Banaskantha, the peak yield level of milk of all other animal type and breed have found higher in case of animals covered under RBP than animals not covered under RBP as well as the level yield level recorded of animals with non-beneficiary households.
- The average milk recorded was higher in crossbred cows than local cows as well as buffaloes. In fact the crossbred cows from selected households in Banaskantha had yielded as high as

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18.63 kg which was covered under RBP, while a corresponding figure for Buffalo was recorded of 12.63 kg. Thus, positive effect of programme on ration balancing could be broadly seen from high level of peak yield figures.

- Except in few cases of cows (cross breed in Surat and local in Banaskantha), milk yield of animals covered under RBP was found higher than animals not covered under RBP of beneficiary households as well as milch animals of non-beneficiary households.
- The highest milk yield of about 14 kg/day was recorded in case of crossbreed cows in Banaskantha and lowest was of local cows in Surat (6.8 kg), both from RBP group. While highest buffalo milk yield on earlier day was recorded in Banaskantha (8.51 kg/day).

7.3 Details on Feed & Fodder

- All the animals selected under RBP were feeded at stall, which is mandatory requirement to balance the diet of particular animal. The selected households in Banaskantha were dependent on purchased fodder to feed their animals, while in case of Surat, households used fodder from both sources (self cultivated & purchased).
- The animals were also feeded with concentrates purchased from the market. The animals covered under RBP in Banaskantha were fed with very lesser amount of concentrates as compared to not only the animals covered under RBP in Surat but also animals not covered under RBP of both groups.

7.4 Details on Veterinary and Breeding Services and Expenditures

- Almost all the animals were given vaccinations (e.g. FMD, HS, BQ, Deworner, Thailera, Swell in Feet, etc), which was mostly received free of cost. Besides, some of selected households had incurred expenditure on medicine and doctor fee as and when some of animals fell sick. On an average, beneficiary household had incurred medicine plus doctor fee cost ranging between Rs. 400-800/- per animal.
- The amount spent towards cost of medicine and doctor on animals not covered RBP by beneficiary households was relatively higher than animals covered under RBP. While expenditure incurred by non-beneficiary households on medicine and doctor was at lower range.
- Despite of various efforts made by the government; availability of veterinary doctor is one of the bottlenecks in dairy development. On an average, every year total number of visit of veterinary doctor ranges 3-4 only. Thus, most of the households had either depend on the alternative source of advisory and medical support for their animals.

7.5 Feeding and Income from Dairying

- In majority of cases, feeding as well as income from dairy was handled by the female members in Surat district, whereas in Banaskantha district, feeding animal work responsibility

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was with female while income was handled by male member. It may be due to the fact that distance between the households and dairy cooperative in Surat is close, thus female pour milk every day in dairy cooperative and also collect the money toward same.

7.6 Disposal of Milk

- On an average, about 90 percent of milk produced had been disposed by the selected households. Thus, hardly around 10 per cent of total milk produced must have either used for the home purpose and used for preparation of further value added products such as ghee, curd, etc.
- In case of beneficiary households, more than 97 per cent of milk was deposited with cooperative milk society and remaining milk was sold to consumer and sweet shop owner. While in case of non-beneficiary households, around 55 per cent of milk was sold to Cooperative milk society followed by around 45 percent milk to consumers.

Sr. No	Particulars	Awareness about the programme (% to responses)					
		Banaskantha		Surat		Total	
		RBP	NRBP	RBP	NRBP	RBP	NRBP
1	Have you heard of RBP (%)						
	No	2.0	44.0	8.0	55.0	5.0	49.5
	Yes	98.0	56.0	92.0	45.0	95.0	50.5
	If yes, source of information on RBP						
	Milk Union-1	4.1	3.6	2.2	12.7	3.2	8.1
	DCS-2	14.3	44.6	13.0	23.6	13.7	34.2
	LRPs-3	76.5	51.8	84.8	63.6	80.5	57.7
	Others (LRP + Coop Soc) ⁴	5.1	0.0	0.0	0.0	2.6	0.0
2	Have you seen any documentary on RBP						
	No	25.0	66.0	24.0	72.0	24.5	69.0
	Yes	75.0	34.0	76.0	28.0	75.5	31.0
	If Yes, specify (Coop Soc)	71.0	34.0	73.0	28.0	72.0	31.0
3	Have you seen any poster/banner on RBP						
	No	34.0	70.0	34.0	72.0	34.0	71.0
	Yes	66.0	30.0	66.0	28.0	66.0	29.0
	If Yes, specify (Dairy Soc)	61.0	26.0	64.0	24.0	62.5	25.0
4	Have you received any pamphlet on RBP						
	No	41.0	81.0	30.0	74.0	35.5	77.5
	Yes	59.0	19.0	70.0	26.0	64.5	22.5
5	Have you attended village awareness program (VAP)						
	No	37.0	58.0	28.0	58.0	32.5	58.0
	Once	36.0	22.0	52.0	37.0	44.0	29.5
	Twice	12.0	13.0	13.0	4.0	12.5	8.5
	Thrice	5.0	4.0	3.0	1.0	4.0	2.5
	More	10.0	3.0	4.0	0.0	7.0	1.5

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7.7 Outreach, Perception & Constraints

- More than 92 percent of beneficiaries were aware about the programme, while corresponding figure for the non-beneficiary household was about 51 percent.
- The major source of information about programme for more than 75 percent of beneficiary household was LRP itself. About same number of beneficiary households had seen documentary on RBP.
- The village awareness programme was attended by the 67 percent of beneficiary and 42 per cent of non-beneficiary households. The pattern was found same in both the selected districts.
- About one third of the selected beneficiary households were not aware about ration balancing before adopting RBP.
- On an average, total nine advisory/recommendations were received till date by beneficiary households in Surat whereas same figure was higher side in Banaskantha having about 14 recommendations.
- More than 77 percent of beneficiary households from both districts opined that benefits of RBP has increased their interest in dairy and would like increase the herd strength.
- The success of RBP can be seen from the fact that more than 88 percent of farmers were following the recommended ration advisory given by LRP, while more than 80 percent household felt that they are in programme.
- Though most of beneficiary households followed the advice given by the LRP, some of them had faced the constraints in regular feeding of recommended ration such as shortage of mineral mixture, frequent change in feed items, LRP do not visit timely and they are not convinced about the recommendations.
- More than 88 per cent of respondents had mentioned that they would recommend other dairy farmers also to join the RBP and rank programme with 8.5 points (out of 10).
- The changes realized by the RBP adopted in various parameters indicate that more than 78 per cent of beneficiary households opined that milk production has increased by around 15 percent after adoption of RBP, i.e. about 1.5 litre/day.
- Not only milk production was increased, the composition of milk was also improved. More than 79 per cent households has realized that on an average milk fat and SNF level has increased before adopting the programme.
- Most of the households have also reported that health of animals is also improved after adoption of RBP. Decrease in digestive disorders of animals after adoption of RBP was experienced by selected sample households.

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- By following the recommended ration given by the LRP under programme, more than half of the selected households have realized reduction in feed cost while same was increased in case of one fourth households while no change was observed by remaining households.

Sr. No.	Particulars	Surat	Banaskantha	Total	
1	Awareness about ration balancing before adopting RBP	No	34.0	38.0	36.0
		Somewhat	40.0	54.0	47.0
		Well aware	26.0	8.0	17.0
2	Av. number of RB recommendation received till date	No./hh	9.1	13.6	11.4
3	Benefits of RBP increased interest in dairy	No	9.0	12.0	10.5
		Yes	81.0	77.0	79.0
		Can't say	10.0	11.0	10.5
4	Would like to increase herd strength	No	20.0	13.0	16.5
		Yes	62.0	71.0	66.5
		May be	18.0	16.0	17.0
5	Feel about involvement in the program	No	6.0	7.0	6.5
		Yes	80.0	85.0	82.5
		Somewhat	14.0	8.0	11.0
6	Following the recommended ration correctly	No	5.0	12.0	8.5
		Yes	95.0	88.0	91.5
7	Constraints in regular feeding of recommended ration	Mineral mixture shortage	18.0	9.0	13.5
		Frequent change in feed items	9.0	13.0	11.0
		Lrp not visit timely	2.0	4.0	3.0
		Not convinced about the recommendations	2.0	6.0	4.0
		Any others	3.0	5.0	4.0
8	Recommend other farmers also to join RBP	No	8.0	12.0	10.0
		Yes	92.0	88.0	90.0
9	Points given to RBP	On a 10 point scale	8.4	8.6	8.5

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Table 6: Changes realized by the RBP Adopters

Sr. No.	Particulars		Changes realized (% to total responses)		
			Surat	Banaskantha	Total
1	Increase in milk production after RBP	No	22.0	19.0	20.5
		Yes	78.0	81.0	79.5
	Avg. Milk Yield (Lit/Day)	Before RBP	10.1	12.6	11.3
		After RBP	11.8	14.2	13.0
2	Improved Composition of Milk	No	17.0	21.0	19.0
		Yes	83.0	79.0	81.0
	Avg. Milk Fat(%)	Before RBP	4.3	5.3	4.8
		After RBP	4.7	5.9	5.3
	Avg. Milk SNF(%)	Before RBP	8.6	5.3	6.9
		After RBP	8.7	5.9	7.3
3	Change in general health of animal after RBP	No	3.0	2.0	2.5
		Yes	84.0	82.0	83.0
		Can't say	13.0	16.0	14.5
4	Experienced decrease in digestive disorders of animals	No	3.0	5.0	4.0
		Yes	80.0	81.0	80.5
		Can't say	17.0	14.0	15.5
5	Change in feed cost of milch animal after RBP	decreased	55.0	53.0	54.0
		increased	21.0	25.0	23.0
		unchanged	24.0	22.0	23.0
6	Additional expenditure (money/labour) is involved in adopting RBP	No	35.0	23.0	29.0
		Yes	25.0	29.0	27.0
		Can't say	40.0	48.0	44.0
7	Any Change in employment opportunity after RBP	decreased	1.0	3.0	2.0
		increased	22.0	21.0	21.5
		unchanged	77.0	76.0	76.5
8	Changes in Monthly income from dairy	decreased	1.0	0.0	0.5
		increased	73.0	75.0	74.0
		unchanged	26.0	25.0	25.5
9	Savings from dairy have increased after adopting RBP	No	4.0	1.0	2.5
		Yes	78.0	83.0	80.5
		Can't say	18.0	16.0	17.0
	if yes, additional saving from dairying utilized for	Education	15.0	3.0	9.0
		Nutrition & health	41.0	44.0	42.5
		Expanding dairying	30.0	26.0	28.0
Others (Edu+Nuti)	14.0	27.0	20.5		
10	After adopting the RBP, milk consumption has increased	No	77.0	91.0	84.0
		Yes	23.0	9.0	16.0

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- Though one fourth of households mentioned that additional expenditure (money/labour) is involved in adopting RBP while three fourth of selected households mentioned that no change in employment opportunity was experienced after RBP.
- More than 73 per cent of households realized that monthly income from dairy has increased after adoption of RBP while about 78 percent households mentioned that their savings from dairy have increased which was utilized for education, nutrition and health as well as for expanding the dairy business.
- Despite of all benefits discussed above, actual consumption of milk in household did not increase significantly.

Sr. No.	Particulars	Benefits realized (% to responses)			
		Surat	Banaskantha	Total	
1	Increase in conception rate	No	31.0	24.0	27.5
		Yes	69.0	76.0	72.5
	If yes then specify avg. of inseminations	Before RBP	2.63	2.51	2.57
		After RBP	1.2	1.19	1.20
2	Reduction in service period	No	36.0	37.0	36.5
		Yes	64.0	63.0	63.5
	If yes then specify avg. service period (in months)	Before RBP	4.20	4.60	4.4
		After RBP	3.03	2.93	2.98
3	Improved lactation length	No	34.0	31.0	32.5
		Yes	66.0	69.0	67.5
	If yes then specify avg. lactation length (in months)	Before RBP	10.19	10.51	10.35
		After RBP	11.81	11.6	11.71
4	Reduced inter-calving period	No	48	33	40.5
		Yes	52	67	59.5
	if yes then specify avg. inter calving period (in months)	Before RBP	14.31	15.39	14.85
		After RBP	12.05	12.77	12.41
5	Reduction in repeat breeding	No	59.0	41.0	50.0
		Yes	41.0	59.0	50.0
6	Help to Control prolapsed of uterus	No	93.0	92.0	92.5
		Yes	7.0	8.0	7.5
7	Help to Control anestrous	No	91.0	67.0	79.0
		Yes	9.0	21.0	15.0
		cannot say	0.0	12.0	6.0
8	Any other (specify)	No	30.0	58.0	44.0
		Yes	0.0	1.0	0.5
		cannot say	70.0	41.0	55.5

- Around two third of the selected household mentioned that after adoption of RBP, rate of conception has increased which had resulted into reduction in average number of artificial inseminations to half from 2.57 to 1.20. The reduction in service period was noted by

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more than 63 per cent of households (from 4.4 to 2.98) while more than 66 per cent of households observed improvement in lactation length (from 10.4 to 11.7).

- Almost half of the respondents experienced reduction in inter-calving period and repeat breeding. The adoption of RBP advisory has helped in controlling the diseases such as prolapsed of uterus as well as anestrous.
- Few suggestions made by selected households for the improvement of RBP and its benefits were regular supply of nutrient and feed, regular health check up of animal health, regular visit and availability of veterinary doctor at village level, need to have subsidy on animal feed and concentrates, and LRP should work seriously.

Table 8: Suggestions for Improvement of RBP

Sr. No.	Suggestions	RBP adopters (% to total)		
		Surat	Banaskantha	Av.
1	Regular Supply of Nutrient & Feed	15.0	0.0	7.5
2	Provide Meaning Equipment	25.0	9.0	17.0
3	Animal Health checkup Camp Facility	8.0	0.0	4.0
4	Training should be provide for animal breeding	10.0	0.0	5.0
5	Subsidy for Animal Food	8.0	0.0	4.0
6	LRP should work properly	0.0	10.0	5.0
7	Regular Veterinary Doctor Facility	0.0	16.0	8.0
8	Concentrate & Food price should be Decrease or Provide Subsidy rate	0.0	7.0	3.5

7.8 Performance of LRPs:

- More than 80 per cent of households had received brief on RBP from selected LRP, while more than 89 per cent households had kept advice slip and was displayed properly.
- Out of 10 points, 8.3 performance points were given to LRP by the selected respondents indicating better working of LRP.
- About two third of respondents mentioned their willingness to pay/like to adopt RB advisory on payment basis after the end of programme, while about one fifth of households refused to pay or mentioned unwillingness to adopt the RBP after the end of the programme on payment basis.

7.9 Milk Unions: Implementation, Monitoring & Evaluation of RBP

- After implementation of RBP in selected coverage area of Union, there was increase in milk procurement, number of DCS as well as pourer members, milk fat, daily milk yield as well as conception rate in both the selected district unions.
- Though other parameters also recorded positive growth after RBP, but less number of veterinary visits is a matter of concern.
- The selected unions had given incentives to selected LRP on the basis of enrolment of animals and subsequent delivery of advisory to selected household. Besides, promoting LRP, Milk Unions had organized Village Awareness Programme in selected villages. In order to have proper monitoring of progress of programme, monthly LRP meeting was conducted to solve the problems through discussion (hardware, software and net connectivity queries).
- Milk unions had to put suitable mechanism in place to ensure sustainability of the programme, such as commission on sale of mineral mixture to LRP (@Rs 5/kg). The Unions also mentioned their willingness to continue this programme after completion of its period by providing commission to LRP on the sale of mineral mixture, concentrates, etc.
- Though at overall level, programme has registered positive growth, Milk Union had faced few constraints while implementing it, such as due to less stipend proper selection of LRP is a tedious task as well as continuation of same person is also overwhelming, internet connectivity problem at field level and laptop battery problem. The selected unions did not face financial problem so far in implementation of this programme.
- Important factor for success of program is the remuneration fixed for LRP and they may continue working as LRP if more amount is paid as remunerative for said work.

8. Conclusions and Policy Implications:

- Adequate supply of nutrient and feed should be ensured either by the district milk unions or by dairy department of state government. Dairy union should provide nutrient and feed on subsidised rate to member dairy farmer.
- The regular health check up of animal health, regular visit and availability of veterinary doctor at village level need to be arranged and monitored by both Government and milk union.
- The remuneration of LRP should be lucrative so as to encourage the local youth to get involved in this program. Proper monitoring of work assigned to LRP should be done by respective milk union.
- Along with the ration balancing advisory services, milk producers also need to be educated, through an efficient extension service, about the importance of quality of drinking water,

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proper feeding mangers, colostrum feeding to newly born calves, suitable chaffing of fodder, de-worming, vaccination, and timely insemination, among others. Some of these messages could be put across through regular group meetings with suitable follow up meetings wherever the RBP is being carried out.

- As no selected dairy farmers had insured their livestock. Therefore, link should be establish between RBP program and animal insurance scheme.
- This project needs to be implemented in the areas with less sizeable population of cattle and buffaloes.

Son Preference: Exploring links with male university students Attitude towards Gender Equality and Childhood Violence Experiences[#]

Introduction

Son preference refers to an attitude which prefers boys over girls and is very much prevalent in many parts of the world especially in Asia. This results into a range of discriminatory practices against girls and women including female feticide, neglect of the girl child in terms of love and care and withholding developmental opportunities like education and nutritional food. Also according to Hudson & Boer (2004) as a result of preference for sons, over the next 20 years in large parts of Asia there will be an excess of males.

IMAGES study (as cited in Thomas, 2017) reported clear significant correlation between men's low gender equality attitude and higher son preference. Gender equality means fairness of treatment for women and men according to their respective needs. This includes equal treatment or treatment that is different but which is considered equivalent in terms of rights, benefits, obligations and opportunities (ILO, 2000). Research has long proved that childhood violence experience of men also act as predictive factors of their high level preference for sons over daughters.

Priya, Abhishek, Ravi, Khuat Thu, Mahesh, Tran Giang, Jyotsna & Prabhat (2014) found that engaging university students and young men is essential to achieve the full equality of women and girls; it also positively impacts the lives of men and boys themselves. Research has continually shown that patterns of gender inequality are interwoven with social definitions of masculinity and men's gender identities. To build a gender-egalitarian society men and boys have to reconsider traditional images of manhood, and reshape their relationships with women and girls. Efforts are being taken and changes of this type are already happening in many parts of the world, but not in all situations or with all men and boys.

Significance of the study

Thomas & Mishra (2012) reported that an important prerequisite for achieving gender equality is changing men's attitude towards gender norms that they internalize and that influence their behaviors. Understanding men's attitude towards gender equality is a prerequisite towards this attempt.

The information obtained as a result of this study would showcase the male university students' attitude towards gender equality and the different aspects of the same in which their perceptions are discriminatory. A clear understanding about their deep rooted patriarchal believes,

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very often the main culprit of their perceived superiority feelings on girls, would be essential to free them from the clutches of patriarchal biases in their early ages. As reported in Times of India (Rajesh, 2018, p. 9) if not changed, this patriarchy which begins with tiny micro-inequalities goes all the way to rapes and lifelong subjugation. More equitable gender attitudes of all, especially men, can improve the skewing sex ratio in India.

Objectives of the Study

1. To assess the attitude of male university students towards gender equality.
2. To assess their level of son preference and childhood violence experiences.
3. To assess the correlation between attitude towards gender equality of the university students and their level of son preference.
4. To guide and influence policies for actively engaging boys [university level] and men [intervention at community and governmental level] for correcting gender inequalities in the society.

Hypotheses

1. The attitude towards gender equality, level of son preference and childhood violence experiences of respondents are significantly associated with their demographical variables like stream of study, religion, family income, area of living, occupation of parents and experience of family violence and abuse.
2. Better the attitude towards gender equality, higher the level of son preference of respondents.
3. Higher the level of childhood violence experiences, higher will be the level of son preference of respondents.

Research Design

Descriptive research design with primary data analysis is be used in this study as the main purpose of this study is to describe the attitude towards gender equality and son preference of male university students.

Sampling Frame

The sampling frame for the present study comprises of male students, in the age group of 20 to 25, doing their masters in post graduate departments of Sardar Patel University, Gujarat state. Systematic sampling method is used to select the respondents from a list of all male students of the University. Care was taken to include students from arts, science and management to ensure diversity in the samples so that the sampling method is stratified and systematic random sampling in nature

Tools of Data Collection

Detailed Interview schedule covering areas of demographical variables and violence experiences during childhood is prepared to understand the respondents' background variables and level of childhood violence experiences. To assess their attitude towards gender equality and son preference following standardized tools are also used.

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- a. Gender Equitable Men (GEM) scale developed by the Horizons Program and Instituto Promundo in Brazil with young men aged 15-24 years (Barker et al, 2011) and later adopted by the IMAGES for adult will be used to assess the men's attitude towards gender equality.
- b. A 12 item - standardized tool developed by International Men and Gender Equality Survey (IMAGES) to explore men's attitude towards son preference.
- c. A list of 5 statements was asked to respondents to understand their childhood violence experiences.

Discussion

The attitude of majority [69.5%] towards gender role is still the "age-old traditional dutiful" woman who's most important role is to take care of her home and cook. A similar attitude is found towards sexuality also as around one-fourth of the respondents think that a wife cannot refuse sex to her husband, a clear evidence for the superior feeling the males have on their spouses' an opinion which clearly echoed the internalized perceptions of men about "submissive sexual role of women".

Even though majority of the respondents didn't support violence on women, the fact that around 38 percent of them are of the opinion that to keep the family together a woman should tolerate violence reverberates the attitude of society that it is the responsibility of a woman to bear all torments to save her family from any type of disorganization. This reflects the pseudo-notions" still many respondents carry with them about the "subservient, dutiful and sacrifice" nature of women. Reproductive health in the eyes of many respondents is still "the sole responsibility of women" even though they admitted that they would be angry to be asked to use contraceptive methods and yet held women responsible for getting pregnant.

Masculinity is cherished by majority of respondents and they believe that a man has to be strong physically and emotionally, a conviction many times deprives them being vulnerable and human too. It is interesting to see now a considerably large proportion [40%] of respondents is ready to admit that it is not always needed to be belligerent to prove their manhood. Inequity attitude towards value of sons and daughters is very much obvious among around one-fourth of the respondents as having a son is considered to be very important by them in this study mainly due to their strong perceptions that only sons can provide ancestor worship, having a son reflects bad karma & lack of moral virtue to parents and a man with only daughters is unfortunate.

Thomas & Mishra (2012) reported that the traditional preference for sons is deeply rooted in the structure of our society. In India sons enjoy a great deal of social prestige. In view of many of their respondents only sons can perform the last rites of their parents; since girls marry into another family, only sons can guarantee for the care of the parents in old age. The presence of at least one son is crucial in the present cultural context where many young respondents

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believed that birth of sons in the earlier parities will reduce their pressure to negotiate with whether to conceive again or not.

The common types of violence experiences of respondents in this study include witnessing fight between parents, physical punishments by parents, mother being physically abused by father and sexual abuses. Research has long confirmed that children exposed to violence are more likely than those not experiencing violence to develop more negative attitude towards gender equality and become victims or perpetrators of further violence. This finding reinforces the need to take steps towards zero tolerance to violence upon children whether direct experiences or witnessing of violence in own families, neighborhoods, schools or community.

Findings of this study also reinforced the preference for sons profoundly embedded in minds of Indians as a little less than one-fourth of the respondents held high level son preference and around half of them reported medium level son preference. This reiterates the fact that high level educational status of respondents could not do much towards making changes in their mindsets which prefer sons over daughters.

This study affirmed that many youngsters are concerned about old age security, lineage, and salvation and at least some of them hold negative attitudes towards daughters like they are financial burden and loss to families; two major perceived reasons why still they hold strong son preference attitudes towards sons.

There is significant difference in the level of gender inequity among different age groups. But age doesn't seem to bear any significant association with level of son preference and childhood violence experiences of respondents. High level of gender inequity, son preference and childhood violence experiences are evident among science students especially with chemistry students compared to arts and management students.

Statistically significant difference is apparent among students from different castes with respect to their attitude towards gender equality and son preference as students from Scheduled Caste seem to have better gender equity attitude as well as low level son preference as compared to students belong to SEBC, Open and ST categories.

While religion does not seem to play much role with the attitude of gender inequity and childhood violence experiences of the respondents, it shows a significant association with the level of son preference of the respondents as the Hindu university students constitute the highest proportion of respondents having high level son preference. The respondents from nuclear families seem to have more gender equitable attitude and less son preference compared to those from joint families, while type of family is not associated with their childhood violence experiences.

Occupational status of mother bears a statistically significant association with respondents' attitude towards gender equality as well as level of son preference, as children whose mothers are working seem to have more equitable attitude towards gender equality and less son preference compared to those whose mothers are housewives. Similarly children of

working mothers reported less violence experiences during childhood. There is a statistically significant difference between the rural and urban respondents as around double of urban respondents reported high level childhood violence experiences compared to respondents from rural areas. However no significant association is found between area of living and the level of son preference and gender inequity attitude of respondents.

Presence of sisters in the family seems to create a negative impact in the attitude of respondents towards gender equality and son preference. Those respondents with sisters reported to have high level son preference and gender inequity attitude compared to those having no sisters. Presence of one brother appears to be a risk factor of high level violence experiences as respondents with one brother constitute the highest proportion of high level childhood violence experiences group compared to those with no brother and two or three brothers.

Conclusion

There is evidence that the traditional patriarchal male dominated attitude continues to be a major problem in India as findings of this study revealed that more than one-fifth (23%) of the young male university students still hold high preferences for sons (Figure.3). At the same time the high level gender inequity attitude (22.5%) as well as high level childhood violence experiences (23.5%) of almost same proportion of them are matters of grave concern and should be taken into consideration seriously (Figure 1&2).

Pearson's correlation proved strong positive correlation between Gender inequity and son preference and it is clear from this study that higher the gender inequitable attitudes of university students, higher will be the level of son preference they are having. In other words, it is undoubtedly proved that those men who are with more inequitable gender attitudes are much more likely to have preference for sons. Similarly Pearson's correlation proved that those men with more childhood experiences of violence are more likely to have higher level of gender inequitable attitudes and son preferences.

Regression analysis also recognized that values of sons and daughters is the most important predictive factor followed by attitude towards gender violence and childhood violence experiences to explain son preferences of university students. Altogether 72 percent of the variation in the level of son preference is explained by their childhood violence experiences, attitude towards value of sons and daughters and attitude towards gender violence.

Men's childhood experiences have momentous impact on their attitude towards gender equality as well as preference for a particular gender child as adults. Men witnessed their father making decisions without consulting mother or sisters in their childhood are less likely to have equitable gender attitudes. Research by Priya, Abhishek, Ravi, Aarushi, Khan, Brahme, Boyle & Sanjay [2014] reported that men who had often witnessed some violent acts or discrimination against their sisters or mothers in their childhood are more rigidly masculine because they internalize this experience. They also found that men who experienced discrimination as children were more likely to be rigidly masculine than those who did not, in most states.

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A report by Kaushik & Dave (2018) states that Gujarat saw the highest decline in sex ratio at birth from 911 in 2011 to 848 in 2016. In 2017, it dropped further to 842 is an evidence of a continued threat of very strong son preferences among people especially among youngsters. In their report they quoted Ms. Jayanti Ravi [Principal Secretary, Health and Family Welfare Department, Gujarat state, saying sex ratio at birth has come down because of the social behaviour of the people and continued lower status given to daughter. Further she stated that laws and schemes alone cannot bring change to society as through a number of government programmes, like Kanya Kelavani, Beti Bachao, Beti Padhao, the Gujarat government has been fighting this social problem for a long time.

Recommendations

It is high time to do whatever possible to curb son preferences from the minds of people especially the young generation of India. It is imperative that we utilize various platforms to reach young boys as the findings of this study undoubtedly pointed towards how the strongly internalised patriarchal gender attitudes particularly the perception towards gender roles, masculinity, lineage and old age security are strongly associated with their son preferences.

It is essential to change the mindsets and behaviour of people to have a healthy sex ratio. Boys should be taught that men and women are equal so that they will not bear any superiority in their attitudes and will try to give up their pseudo notions like "cook, wash, take care of children" etc are not men's responsibilities. It will teach them there is no need to feel shame in doing the household work and instead will feel pride in doing so. And one doesn't feel proud in saying that "I don't know how to cook, or "if my mother or sister is not at home, I will have food from outside". Instead they would realise that it is good to do things for oneself and for all. That would boost their self-esteem and self-respect and they would be considered like genuine, cool and friendly by family and friends.

Towards promotion of gender equality more men can be involved in the activities which will enable children learn the dignity of all work without any gender label with it like cooking, washing, cutting vegetables, taking care of children etc. Fathers who share household work can be good models for growing children as they understand that it is the responsibility and get happiness when both husband and wife share their household responsibilities.

Men who bear equitable attitude towards gender equality and share household responsibilities should be encouraged to share their good feelings with others and should be helped to talk about it in the society with ease and proud. Media also can do a lot in this direction. The programmes highlighting the value of equal division of labour within families and shows portraying husbands helping their wives in household work as happy, content, honest and satisfied can eradicate the shame feeling which prevents many men from giving helping hands in household activities.

It is widely seen that fear of being ridiculed by society including kith and kin averts many from extending help to spouses in completion of household work especially cooking,

washing, cleaning and so on . It is very important to have continuous, focused and specific engagement of men especially boys to help them redefine their internalized perception of masculinity right from their own homes, schools, community, college and job settings.

Systems which can ensure the old age security, for example, pension schemes and medical insurances capable of completely making the old financially independent from sons or daughters can help parents not to have apprehensions in giving birth to children of any gender. As old age security is an important reason perceived by many respondents for having son preference, this move will help several people to get way with son preferences attitude.

Efforts should be taken to make women financially independent as financial empowerment will enable them to be more supportive to their natal kin in their old age. Now there should be focused attempts to make changes in the attitude of people, especially of youngsters that after marriage a woman completely belongs to her husband's family and she is not supposed to support her parents financially at all. That is the reason why accepting monetary help from married daughters is considered to be dishonorable by many parents and not acceptable by many husbands and in-laws. Changes can be seen among well educated and well- earned daughters who managed to take the responsibility of their parents, a liberty they earned by means of financial empowerment. Indian parents once in foreign land live with their married daughters with ease prove that attitudes and practices would be changed with empowerment.

Systematic and continuous efforts towards awareness and education can make drastic changes in the common perceptions among people like "only sons can provide ancestor worship, having a son reflects bad karma & lack of moral virtue to parents and a man with only daughters is unfortunate". A focused attention towards this change in practice, which may reduce the patriarchal preferences of the societies, can bring in far reaching results and youth can be involved in the advocacy programmes.

The continuously skewing sex ratio at birth asserts the need of developing curriculum that teaches children including boys the value of gender equity and ill effects of skewed sex ratio in their minds.

Confidence building efforts may be taken up by the government to ensure safety and security of girls in urban areas especially because many urban parents are dual earners and safety of girl children when they are out can be a serious matter of concern, a reason felt by respondents of this study also, why the juvenile sex ratio is continuously getting skewed in urban areas compared to rural areas throughout the country.

Men who are with more equitable gender attitudes and do not hesitate in practicing it in own lives can be used as change agents as it will enable other men to learn and unlearn from them. More dialogues, open discussions and debates can be conducted in school settings especially for high school and higher secondary students where boys and girls can have a better understanding of and perception with internalization of equitable gender norms.

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Inter-disciplinary projects and programmes should be run by universities where the science and non science students along with their faculty members may work together and will have opportunities to research on social issues like skewed sex ratio with its biological, medical, physical, psychological, cultural, gender, developmental, social, anthropological and familial causes and consequences.

It will enable them to understand the significance of having a gender friendly society to achieve better human development index score with a high GDP score, two essential development indices for any country to be considered as a developed one. Community, district and state based educational programmes need to be calibrated to address caste-specific and socio-religious practices that reinforce son preference in India. In-depth research is recommended to understand the circumstantial influences which endorse the attitudes of people towards equal preference for sons and daughters.

According to Nanda Priya et.al (2012) it is critical to bring men and women together in a strategic manner across different types of programs and sectors to create platforms and avenues where traditional gender roles are confronted and challenged.

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Table 1: Distribution of respondents according to their stream of study

Sr.No	Stream of Study	Frequency
1	Arts	64
2	Science	74
3	Management	62
	Total	200

Table 2: Correlations between Gender Inequitable attitude and Violence Experiences with Son Preference

		<i>Son Preference</i>	<i>Gender Inequity</i>	<i>Childhood Violence Experiences</i>
<i>Son Preference</i>	Pearson Correlation	1	.745**	.605**
	Sig. (2-tailed)		0	.000
	N	200	200	200
<i>Gender Inequity</i>	Pearson Correlation		1	.467**
	Sig. (2-tailed)			.000
	N		200	200

****.** Correlation is significant at the 0.01 level (2-tailed).

Table 3 : Table showing model summary of regression analysis.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.849 ^a	0.721	0.716	4.89659

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Table 4: Table showing the regression analysis for Dependent Variable Son Preference

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	4.536	1.065		4.258	.000
Attitude towards gender violence	0.54	0.085	0.278	6.365	.000
Values of Sons and Daughters	1.444	0.138	0.538	10.432	.000
Childhood Violence Experiences	0.913	0.203	0.208	4.509	.000

Figure 1: Levels of Gender Inequity

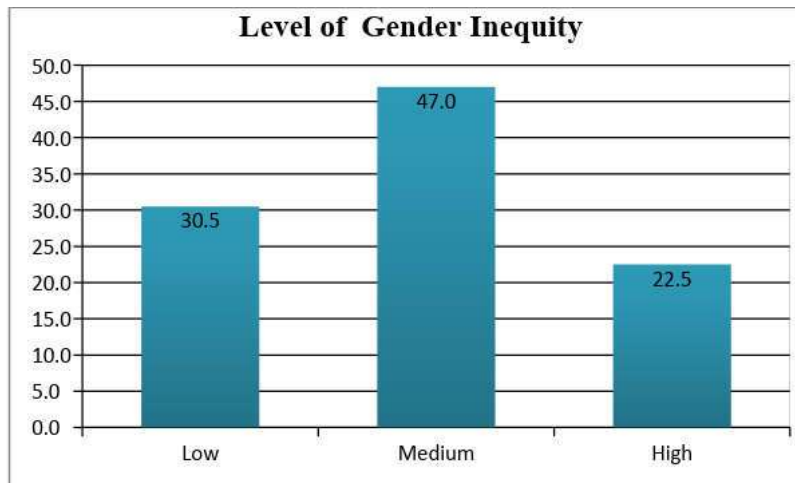


Figure 2: Levels of Childhood Violence Experiences



Figure 3: Levels of Son Preference

