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Impact of National Food Security Mission on Production and Incomes of Paddy Farmers: An Economic Study in Hassan District, Karnataka

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ABSTRACT

An evaluative study on the impact of National Food Security Mission programmes in Hassan district, Karnataka, revealed that the programme interventions enhanced paddy productivity by 9.02 per cent over non-NFSM paddy growers besides increasing net income and employment. The dummy variable regression analysis showed that SRI method of paddy cultivation enhanced paddy productivity by 8.5 and 5.78 quintals per acre over non-NFSM farmers in two study taluks of Hassan and Sakaleshapura. The incremental income per rupee of cost was higher due to NFSM interventions. In view of its positive impact on productivity of paddy, NFSM programmes may be scaled up to realise the programme objectives..

Keywords: National Food Security Mission, SRI method of cultivation

JEL: Q11, Q16, Q18

I

INTRODUCTION

India, with a population of over 1.2 billion, accounts for more than 17 per cent of the global population and 456 million of poor (41.6 per cent) are living on less than $1.25 a day (Chen and Ravallion, 2008). Ensuring food and nutritional security for such a massive population is a major challenge for India. Experts opine that with rapid rise in population and increasing income levels, the current food production may be insufficient to meet increasing demand for food.

Recognising the steady rise in aggregate demand for food grains by the growing population, the Government of India has launched a massive programme entitled "National Food Security Mission" (NFSM) in August 2007 to increase the food grain production. The overall objective of this programme is enhancing the productivity and production of major cereals-paddy and wheat- and pulses in the country on a sustainable basis to ensure food security. The major pathway identified for achieving this objective is narrowing the yield gap of these crops through dissemination of improved technologies and farm management practices. NFSM has identified several practices and technologies to enhance paddy productivity. The important among these

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are the application of lime, timely plant protection measures, use of micro-nutrients, use of cono-weeders, adoption of package of practices (PoP), adoption of System of Rice Intensification (SRI) method and training paddy farmers under Farmers' Field School (FFS) concept. These interventions are designed to implement at farm level laced with incentives and subsidies. Some of these practices/technologies have the potential to raise the productivity of paddy substantially. For example, SRI method has the potential to raise the productivity and savings in inputs (Reddy *et al.*, 2005; Basavaraja *et al.*, 2008).

The major goal of NFSM programme is to increase the production of paddy by 10 million tonnes, wheat by 8 million tonnes and pulses by 2 million tonnes by the end of the Eleventh Plan. In addition, the programme also envisages creation of additional employment at farm level. The mission has three separate components for paddy, wheat and pulses. The interventions envisaged in the programme were launched in 15 states with a well-structured action plan and several initiatives to augment productivity of target crops.

The NFSM programme is in operation since 2007-08 in the country. The programme has completed three years (as on 2010-11) with implementation of envisaged interventions for paddy. The action plan for Karnataka envisages spending of Rs. 195.29 million on various activities for the selected crops in 2010-11. The three year time period can provide a great deal of insights about the performance of the programme so that measures can be initiated to improve the performance further. Hence, there is a need to evaluate impact of interventions on the productivity and economics of paddy. In this background, the present study was undertaken in Hassan district, Karnataka to analyse the impact of NFSM interventions on production and incomes of paddy growers.

II

METHODOLOGY

The NFSM has drawn up a sampling procedure for the selection of districts, NFSM activities and respondent farmers for the concurrent evaluation. The same sampling procedure was adopted for the selection of respondents for the present study. Hassan district was purposively selected for the evaluation as it was identified by NFSM as the sample district for Southern Karnataka. Hassan is one of the leading paddy growing districts in the state, where paddy was grown in an area of 53,146 hectares in 2009-10 with 1,28,074 tonnes of production and an average yield of 2,153 kg per ha.

(a) *Database and Sampling*

Adopting the sampling framework prescribed by NFSM, three beneficiaries for each NFSM intervention were selected to form a sample size of 30 beneficiaries and

15 non-beneficiaries each for Hassan and Sakaleshapura taluks, making a total simple size of 90. Under NFSM, several interventions are envisaged including new technologies, input usage, farm machinery and equipment, training to farmers and others to augment the productivity of paddy. However, only seven interventions were considered for the analysis as they involved use of material inputs or equipment or technologies directly by the farmers. Thus, 21 farmer households were included for the analysis of productivity contribution of seven interventions to paddy yield. For the assessment of overall economics of paddy crop in the study area, all 30 sample farmers were considered. From the list of beneficiaries covering various interventions obtained from the Hassan district office of the State Department of Agriculture, beneficiaries were selected randomly. For demonstrating the impact of NFSM interventions, the Department of Agriculture selected farmers in such a way that beneficiaries received one or two inputs or interventions. But, a few farmers received all inputs solely for demonstration of impact of package of practices. In the sample selected, care was taken to include farmers using one or the other intervention for evaluation. The secondary data were collected from the Directorate of Economics and Statistics, (DES), State Department of Agriculture, Hassan and related departments.

A structured schedule was developed and it was pretested before data collection. Data pertaining to cultivation practices of paddy, NFSM interventions, expenses on inputs and related information were collected from NFSM beneficiaries. Data on paddy production were also collected from non-beneficiaries (control farmers) for comparison. Control farmers in the study area did not receive any benefit or even technical knowledge from NFSM. Data pertaining to crop year 2010-11 were collected through personal interviews.

(b) *Analytical Tools*

The data were analysed using concepts in agricultural economics. The economics of paddy production was assessed on per acre basis. Costs were categorised as variable and fixed costs. Variable costs included costs on labour, material inputs, interest on working capital and marketing costs. Material costs included expenditure on seeds, fertiliser, farm yard manure (FYM), etc. Family labour used in the paddy production was imputed on the basis of prevailing wage rate. Fixed costs included interest on fixed capital, depreciation, land revenue and rental value of land. The value of own farm assets was imputed taking into account the depreciation due to use of these assets in the production of paddy crop.

The economics of paddy was also assessed using the farm management cost concepts as detailed below. Returns to various factors of production can be assessed by using the cost concepts of Cost A, Cost B, Cost C and their variants. The Cost A_1 includes the following 15 items of cost which covered both cash and opportunity costs as below: (i) hired human labour, (ii) hired bullock labour, (iii) machine labour, owned and hired, (iv) value of owned bullock labour, (v) value of owned machinery,

(vi) hired machinery, (vii) seed, farm produced and purchased, (viii) insecticides and pesticides, (ix) value of manure (owned and purchased), (x) fertilisers, (xi) depreciation of implements and machinery, (xii) irrigation charges, (xiii) land revenue, (xiv) interest on working capital, and (xv) miscellaneous expenses (artisans, etc.) (Kahlon and Singh, 1980).

The gross income minus Cost A_1 reveals farm business income and returns accruing to capital, land, family labour and management. The Cost A_2 consists of Cost A_1 and rent paid for leased-in-land.

The Cost B_1 comprises the Cost A_1 and interest on value of owned fixed capital (other than land) and net income over this cost gives an idea of income going to land, family labour and management. If rental value of owned land is added to Cost B_1, it will be Cost B_2 and net of this cost reveals returns to family labour and management.

Cost C_1 includes Cost B_1 and imputed value of family labour. Cost C_2 is Cost B_2 plus imputed value of family labour and net income over this cost is the returns to management. Cost C_2* is an intermediate concept and estimated as Cost C_2 plus additional value of human labour due to consideration of statutory minimum wage rate. Cost C_3 is the Cost C_2* plus 10 per cent of Cost C_2 towards the managerial tasks performed by farmers as recommended by CACP.

The gross income was estimated by multiplying the paddy grain and straw output with their prices. The net income was computed by deducting total costs from gross income. The net rate of return was estimated by dividing net income with total costs.

For estimating the contribution of different practices implemented under NFSM to paddy yield, a dummy variable regression model was used. The focus of the study was to assess the productivity impact of NFSM interventions on paddy. Hence, only the intercept dummy variable regression model was used although land holding, level of education and other variables may influence the production of paddy. The differences in respect of paddy cultivation across the beneficiaries and non-beneficiaries were incorporated in the analysis by considering the intercept as yield obtained by non-beneficiaries and this is treated as benchmark category. The incremental paddy yield obtained by NFSM farmers was represented through the regression coefficient associated with each dummy variable (NFSM interventions). Dummy variables were constructed for each of the components of NFSM namely, lime (D_1), plant protection chemicals (D_2), micro-nutrients (D_3), cono-weeders (D_4) , package of practices (PoP) (D_5) , System of Rice Intensification (SRI) method (D_6) and farmers' field school (FFS) (D_7). As all farmers were not given all seven components together, the dummy variable regression model will enable us to assess the contribution of each component to the paddy yield by the respective regression coefficient. The regression coefficients of dummy variables facilitate comparison of each intervention with control variable (paddy yield of non-beneficiaries represented by intercept).

The functional form of the regression model is given below.

$$Y_i = \beta_0 + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \beta_6 D_6 + \beta_7 D_7$$

where Y_i = yield of paddy per acre in quintals.
β_0= intercept or yield obtained under control (non-beneficiaries, benchmark)
$\beta_1$to β_7= regression coefficients associated with dummy variables D_1 to D_7.

D_1 to D_7 = Dummy variables associated with the seven interventions as explained earlier. The incremental yield of each intervention is given by its regression coefficient, which is over and above the intercept coefficient (without NFSM programme). The model was estimated through the ordinary least squares (OLS) method (Gujarati *et al.,* 2014).

The SRI method of paddy cultivation is an innovative method, in which paddy crop is raised under protective irrigation unlike traditional flooding method of paddy cultivation. The seed rate per acre is quite low at 7-8 kg and irrigation schedule is once in a week or 10 days depending on the moisture status of soil. Therefore, there will be a considerable amount of savings of resources (seed, irrigation water and labour) and cost in SRI method.

(c) *Incremental Employment Generation*

As NFSM farmers adopt more intensive cultivation of paddy, employment generation among NFSM farmers is likely to be higher. For each operation in paddy production, incremental employment was estimated for NFSM beneficiaries over non-NFSM farmers.

III

RESULTS AND DISCUSSION

(a) *Impact of NFSM Programmes on Productivity and Incomes of Paddy Farmers*

The productivity and income differentials between NFSM and non-NFSM paddy farmers were estimated by computing costs and returns per acre. As a preamble to this, the pattern of input use by both beneficiaries and non-beneficiaries was analysed as presented in the following sections.

Input Use Pattern in Paddy Cultivation in Hassan District

The input use pattern in paddy production as summarised in Table 1 revealed that the beneficiaries had used slightly higher seed rate than non-beneficiaries in both the taluks. The NFSM farmers used higher seed rate in Sakaleshapura taluk (31.58 kg/acre) than in Hassan taluk (28.68 kg/acre), due to higher seed mortality rate because of higher rainfall and acidic soils in Sakaleshapura taluk. The beneficiaries in Hassan taluk had used higher quantities of nitrogen (38.46 kg), phosphorous (21.8 kg), and potash (8.04 kg) than non–beneficiaries. In Sakaleshapura taluk, the usage of nutrients of nitrogen, phosphorous and potassium was higher among the beneficiaries

at 42.10, 27.60 and 7.40 kg per acre, respectively as against 35.42, 17.39 and 5.0 kg among non-beneficiaries. However, non-beneficiaries had spent more on plant protection chemicals in both the taluks.

TABLE 1. PER ACRE INPUT USE AMONG PADDY FARMERS IN HASSAN DISTRICT

Sl. No. (1)	Particulars (2)	Hassan taluk			Sakaleshapura taluk		
		NFSM farmers	Non-NFSM farmers	Per cent change over non-beneficiaries	NFSM farmers	Non-NFSM farmers	Per cent change over non-beneficiaries
		Quantity (3)	Quantity (4)	(5)	Quantity (6)	Quantity (7)	(8)
1.	Seeds (kg)	28.68	27.25	4.99	31.58	36.14	-14.43
	Fertilisers						
a)	N (kg)	38.46	33.16	13.78	42.10	35.42	15.86
b)	P (kg)	21.8	16.50	24.31	27.60	17.39	36.99
c)	K (kg)	8.04	4.20	47.76	7.40	5.06	36.62
3.	Farmyard manure (tonnes)	7.64	6.18	19.10	4.31	3.80	11.83
4.	Plant protection chemicals (Rs.)	169.13	350.20	-107.05	124.20	145.30	-16.98
5.	Human labour (man-days)	61.35	53.45	14.78	59.25	55.71	6.35
6.	Bullock labour (days)	3.5	6.45	-84.28	2.16	4.56	-111.11
7.	Machine labour (hours)	6.52	6.80	-0.04	7.36	4.57	37.90
8.	Electricity and fuel charges (Rs,)	130	140.00	-7.69	---	---	11.51
9	Average farm size	6.6	6.03	9.45	7.07	4.63	52.69

The input use pattern among the beneficiary farmers varied vis-a-vis recommended level of inputs for paddy production. The recommended level of seed rate and N, P and K nutrients per acre was 25, 40, 20 and 20 kg. However, the beneficiary farmers in both the taluks had used about 15 and 26 per cent higher seed rate than recommended level. In respect of nutrients, the beneficiary farmers in the Hassan taluk used 3.85 per cent less of nitrogen, 9 per cent higher quantity of P and about 60 per cent less of potash as against recommended levels. In the case of Sakaleshapura taluk, while the use of N and P nutrients was higher by 5.25 and 38 per cent, farmers used about 63 per cent less of potash vis-à-vis recommended levels. Paddy farmers in Sakaleshapura taluk applied higher quantity of fertilisers to replenish lost nutrients due to heavy rainfall in the region.

With respect to labour input, it was almost same in both the taluks at 61.58 and 59.88 man days per acre, respectively in Hassan and Sakaleshapura taluks. In general, labour employment was higher among the beneficiary farmers. This could be due to more intensive cultivation and higher yields among beneficiaries. Use of bullock labour and machinery in paddy production was higher among beneficiaries in both the taluks. Thus, it can be inferred that the beneficiaries of NFSM used higher

magnitude of inputs and labour in paddy production than non-beneficiaries due to large scale adoption of NFSM activities.

Productivity Impact of NFSM on Paddy

The impact analysis of productivity gains of paddy assumes importance due to thrust given to yield augmentation under NFSM action plans. As a consequence of adoption and use of recommended improved practices and inputs, the productivity of paddy in Hassan taluk increased by 1.74 quintals per acre among the beneficiaries at 22.56 quintals per acre as against 20.82 quintals among non-beneficiaries (Table 2). The incremental yield of 1.74 quintals represented 8.36 per cent rise in yield due to NFSM programmes. In Sakaleshapura taluk, the yield obtained by NFSM and non-NFSM beneficiaries was 14.20 and 12.90 quintals per acre. The additional yield due to NFSM was 1.30 quintals which translated to 10.08 per cent rise in yield. By and large, paddy yields were lower in Sakaleshapura taluk due to higher rainfall leading nutrients loss.

TABLE 2. ECONOMICS OF PADDY PRODUCTION IN HASSAN DISTRICT

(*Rs./acre*)

		Hassan Taluk					SakaleshapuraTaluk				
		NFSM farmers		Non-NFSM farmers		Per cent change over	NFSM farmers		Non-NFSM farmers		Per cent change over
Sl. No. (1)	Particulars (2)	Quantity (3)	Value (Rs) (4)	Quantity (5)	Value (Rs.) (6)	non-beneficiaries (7)	Quantity (8)	Value (Rs) (9)	Quantity (10)	Value (Rs) (11)	non-beneficiaries (12)
1.	Main product* (quintals)	22.56	1050.00	20.82	1050.00	8.36	14.20	1050.00	12.90	1050.00	10.08
2.	By-product (tractor loads)	3.65	2000.00	3.44	2000.00	6.10	4.02	2000.00	3.82	2000.00	5.24
3.	Total variable cost	---	17809.30	---	17698.3	0.63	---	16288.00	---	15352.19	6.09
4.	Total cost	---	20889.59	---	20784.15	0.51	---	18946.11	---	18005.09	5.23
5.	Gross returns	---	30988.00	---	28741.00	7.82	---	22950.00	---	21185.00	8.33
6.	Net returns over variable cost	---	13178.66	---	11042.65	19.34	---	6662.34	---	5832.81	14.22
7.	Net returns	---	10098.41	---	7956.85	29.91	---	4003.89	---	3179.91	25.91
8.	Net returns per rupee of variable cost	---	0.57	---	0.45	26.76	---	0.25	---	0.21	19.05
9.	Net returns per rupee of total cost	---	0.48	---	0.38	26.32	---	0.21	---	0.18	16.67

*The overall increase in yield of paddy due to NFSM was 1.52 quintals per acre (9.02 per cent).

The overall impact of the NFSM programme was assessed in terms of incremental yield obtained by all farmers in the Hassan district. The average yield of paddy in Hassan district was 18.38 quintals per acre among beneficiaries and 16.86 quintals among the non-beneficiaries. The additional yield of 1.52 quintals per acre translated into 9.02 per cent increase among beneficiaries. The overall yield increase due to NFSM programmes in Hassan district can be termed as a reasonable increase. Considering the importance given to the programme and adoption of inputs and technology, the yield differentials should have been still higher. The results pertain to the first three years of the programme; hence, some initial field level constraints have to be tackled by the implementing agency. Nevertheless the programme has evoked keen interest among farmers and helped farmers to overcome some of the problems in soil and land management. The strong positive attitude and keenness of farmers to adopt NFSM recommendations could result in higher productivity in future.

Impact of NFSM on Income from Paddy

The impact of NFSM on income of paddy farmers was analysed by assessing economics of paddy production. Total income obtained per acre from paddy cultivation by beneficiaries in Hassan taluk was Rs. 30,988.00. The net profit after subtracting all costs was Rs. 10,098.41 per acre. Net return per rupee of total cost was 0.48. The non-beneficiaries obtained a gross income of Rs. 28741.00 and net income of Rs. 7,956.85 (Table 2). The net return per rupee of total cost was 0.38. Although NFSM farmers realised only 8.33 percent as additional gross income from paddy, they realised a greater additional net income to the extent of 29.91 per cent. The appreciable rise in net income among NFSM farmers was attributed to higher yield and cost effectiveness due to scale economies.

NFSM farmers in Sakaleshapura taluk realised a gross income of Rs. 22950 per acre, which was higher than that of the non-beneficiaries (Rs. 21185). NFSM farmers realised an additional income of Rs. 1795 per acre over non-NFSM farmers. The incremental net income of NFSM farmers represented an increase of 25.91 per cent over non-beneficiaries. Results clearly indicated that NFSM programmes had positive impact on incomes of paddy farmers in Hassan district.

(b) *Cost Effectiveness in Paddy Production*

It is expected that due to enhanced paddy productivity, cost of production of paddy would decline as a result of scale economies. This was evident in Hassan taluk where cost of cultivation of paddy was almost the same in both the categories. However, the cost of production per quintal of paddy was lower among NFSM beneficiaries due to higher yield of 1.74 quintals per acre among beneficiaries in Hassan taluk resulting in cost reduction by Rs. 72.32 per quintal among beneficiaries. Further, it was noticed a reduction of Rs. 41.56 in cost per quintal of additional yield

(Table 3). There was an increased net return of Rs. 2141.56 to the beneficiaries as compared to the non-beneficiaries. The net income per quintal of additional yield was Rs. 1230.78. Thus, the beneficiary farmers in Hassan taluk realised scale economies (cost effectiveness) in paddy production.

TABLE 3. COST EFFECTIVENESS IN PADDY PRODUCTION TO NFSM BENEFICIARIES

(*Rs./acre*)

		Hassan taluk		Sakaleshapura taluk	
Sl.No.	Particulars	Beneficiaries	Non-beneficiaries	Beneficiaries	Non-beneficiaries
(1)	(2)	(3)	(4)	(5)	(6)
1.	Cost of cultivation	20889.59	20784.15	18946.11	18005.09
2.	Yield of paddy (quintals/ acre)	22.56	20.82	14.20	12.90
3.	Increase in yield(quintals/ acre)	1.74	---	1.30	---
4.	Gross returns	30988.00	28741.00	22950.00	21185.00
5.	Cost of production (Rs./quintal)	925.96	998.28	1334.23	1395.74
6.	Reduction in cost of production (Rs./quintal)	72.32	---	61.51	---
7.	Reduced cost per incremental yield (Rs./quintal)	41.56	---	47.32	---
8.	Net returns per acre (Rs.)	10098.41	7956.85	4003.89	3179.91
9.	Increased net returns (Rs.)	2141.56	---	823.48	---
10.	Increased net returns per quintal of incremental yield	1230.78	---	633.44	---

A similar pattern was noticed in Sakaleshapura taluk that beneficiary farmers realised 1.3 quintals of incremental yield per acre over non–beneficiaries. Hence the cost of production was lower by Rs. 61.51per quintal. The beneficiaries were cost effective to the extent of Rs. 47.32 per additional quintal of yield. Thus, beneficiary farmers were able to realise benefits of scale economies in cost due to increased output of paddy (Table 3). This also clearly reflects the positive impact of the NFSM programme in the district.

(c) *Economics of Paddy Production based on the Farm Management Cost Concepts*

The economics of paddy production based on farm management cost concepts reveals returns accruing to different resources or factors used in paddy production. As depicted in Table 4, Cost A_1 which represents the cost incurred on 15 items worked out to Rs. 15476.64 per acre in Hassan district among NFSM beneficiary farmers, which was 1.78 percent higher than that of non-NFSM farmers. The magnitude of Cost B_2 was 17985.97 per acre and net of this cost from gross income gave Rs. 8983.03 as returns accruing to the family labour among the beneficiary farmers. In the case of non-NFSM farmers, income accruing to the family labour was only Rs.7505.91, which was 19.68 percent less than that of beneficiaries. When all costs are accounted for, in paddy cultivation, the net income (over Cost C_2) was higher by

23.44 per cent at Rs. 6823.25 per acre among beneficiaries as against Rs. 5527.56 among non-NFSM farmers. This net income was the income accruing to farmers after all costs including opportunity of factors of production are taken into account. Since the farmer acts as an entrepreneur taking various management tasks on the farm, the CACP suggests to account for the management tasks at 10 per cent of Cost C_2. When this provision is made in the form of Cost C3, the net incremental income among beneficiaries was higher by 34.17 per cent. Thus, even on the basis of farm management concepts which express returns to various factors of production, paddy cultivation was more profitable among the beneficiary farmers vis-a-vis non-beneficiary farmers.

TABLE 4. ECONOMICS OF PADDY PRODUCTION UNDER NFSM PROGRAMME IN HASSAN DISTRICT BASED ON THE FARM MANAGEMENT COST CONCEPTS

(*Rs./acre*)

Sl. No. (1)	Type of cost (2)	Adopters (3)	Non-adopters (4)	Change (5)	Per cent change (6)
1.	Cost A_1	15476.64	15206.29	270.35	1.78
2.	Cost A_2	15476.64	15206.29	270.35	1.78
3.	Cost B_1	15752.63	15457.09	295.54	1.91
4.	Cost B_2	17985.97	17457.09	528.88	3.03
5.	Cost C_1	17912.42	17435.44	476.98	2.74
6.	Cost C_2	20145.75	19435.44	710.31	3.65
7.	Cost C_3	22160.32	21378.98	781.34	3.65
8.	Gross income	26969	24963	2006	8.04
9.	Farm business income	11492.36	9756.71	1735.65	17.79
10.	Farm labour income	8983.03	7505.91	1477.12	19.68
11.	Net income	6823.25	5527.56	1295.69	23.44
12.	Net income after provision for management tasks.	4808.68	3584.02	1224.66	34.17

(d) *Economics of Adoption of Material Inputs and Non-Material Technologies in Paddy Production*

The NFSM programme lays emphasis on the adoption of paddy production technologies such as SRI method and FFS which are either input saving or output augmenting ones. In this section a comparative economics of three scenarios (non-material input technologies of SRI and FFS, material input use among the NFSM farmers and non-NFSM farmers) is discussed as depicted in Table 5.

In SRI method of paddy cultivation, a considerable economy is achieved in the use of seed and irrigation. On an average, farmers adopting SRI and FFS realised a cost saving on seed to the extent of 22.87 and 45.79 per cent, respectively over NFSM farmers who used material inputs and non-NFSM farmers. But, total cost in this group was slightly higher by 2.19 and 5.06 per cent vis-a-vis NFSM farmers who used material inputs and non-NFSM farmers, mainly due to use of higher quantity of FYM. But, in the case of material input use farmers, the total cost was higher by 4.22 per cent than non-NFSM farmers.

TABLE 5. COST AND RETURN STRUCTURE OF RICE FOR THE FARMERS WHO ADOPTED NON-MATERIAL TECHNOLOGIES OF FFS & SRI METHOD UNDER NFSM

(*Rs./acre*)

		NFSM Beneficiaries who				Percent change of economics of	
Sl.No.	Particulars	Adopted SRI and FFS	Used material inputs	Per cent change (3-4)/ 4*100	Non-beneficiaries	SRI and FFS over non-beneficiaries (3-6)/6*100	Use of material inputs over non-beneficiaries (4-6)/6*100
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	Variable cost						
1.	Seeds	469.25	608.40	-22.87	865.60	-45.79	-29.71
2.	Fertilisers	1249.79	1432.97	-12.78	906.60	37.85	58.06
3.	Farmyard manure	2217.30	2042.57	8.55	1864.50	18.92	9.55
4.	Plant protection chemical	151.60	142.40	6.46	240.85	-37.06	-40.88
5.	Human labour	7429.65	7199.28	3.20	6594.50	12.66	9.17
6.	Bullock labour	1140.51	1200.57	-5.00	2110.11	-45.95	-43.10
7.	Machine labour	3100.68	3324.70	-6.74	2800.08	10.74	18.74
8.	Electricity and fuel charges	148.16	135.99	8.95	140.00	5.83	-2.86
9.	Total working capital	15906.94	16086.88	-1.12	15522.24	2.48	3.64
10.	Interest on working capital @7per cent p.a	1113.49	1126.08	-1.12	1086.56	2.48	3.64
11.	Total variable cost	17020.43	17212.96	-1.12	16608.80	2.48	3.64
II	Fixed cost						
1.	Land revenue	20.00	20.00	0	20.00	0.00	0.00
2.	Rental value of land	2500.00	2200.00	13.64	2200.00	25.00	10.00
3.	Depreciation	260.55	243.22	1.90	260.00	0.21	-6.45
4.	Interest on fixed capital @11 per cent p.a	306.40	270.95	7.97	250.80	22.17	8.03
5.	Total fixed cost	3086.95	2734.17	7.97	2530.80	21.98	8.04
6.	Total cost	20107.38	19947.13	2.19	19139.60	5.06	4.22
III	Returns						
1.	Yield (q/ac)	26.26	20.56	27.72	16.86	55.75	21.95
2.	Gross returns from grain and straw	35233	29248	20.46	24963	41.14	17.17
3.	Net returns	15125.62	9300.87	62.63	5623.40	168.98	65.39
4.	Net returns per rupee of total variable cost	0.89	0.54	64.81	0.34	154.29	54.29
5.	Net returns per rupee of total cost	0.75	0.47	59.57	0.30	150.00	56.67

With respect to yield of paddy, the first group of farmers realised highest yield of 26.26 quintals per acre, whereas the other two groups realised 20.56 and 16.86 respectively. The net income over all costs was highest among the first group of farmers followed by material input use NFSM farmers and non-NFSM farmers. The results clearly reiterated the increased profitability of SRI method and FFS in paddy cultivation. This result was also corroborated by the studies of Basavaraja *et al.* (2008), Rama Rao (2011) and Haldar *et al.*, (2012) who reported that SRI method gave increased returns to farmers.

(e) *Contribution of Different Interventions of NFSM to the Yield of Paddy*

Results of Dummy Variable Regression Analysis for Hassan Taluk

Under NFSM, several new technologies and practices were introduced to farmers for augmenting productivity of paddy. To quantify the contribution of these technologies and practices to the yield of paddy, a dummy variable regression function was fitted. Seven practices or inputs were introduced in paddy cultivation. However, all seven NFSM practices were not implemented in all paddy fields. Instead each farmer received one or two components of NFSM. The regression coefficients of intercept and explanatory variables SRI method, pump set, FFS and POP were statistically significant contributing positively to the yield of paddy in Hassan taluk (Table 6). The coefficient of multiple determination (R^2) was 0.77 implying that 77 per cent of the variation in the paddy productivity was explained by the independent variables included in the model.

TABLE 6. IMPACT OF INTERVENTIONS ON PADDY YIELD IN HASSAN TALUK: RESULTS OF DUMMY VARIABLE REGRESSION MODEL

		Hassan taluk		Sakaleshapura taluk	
Sl. No.	Interventions	Regression coefficient	t- values	Regression coefficient	t- values
(1)	(2)	(3)	(4)	(5)	(6)
1.	Intercept/ non-beneficiary	20.25***	39.89	12.20***	34.14
2.	Lime	-0.861	0.25	0.45	0.56
3.	PPC	1.50	1.49	1.28	1.60
4.	Cono-weeder	0.25	0.22	-0.08	-0.10
5.	SRI Method	8.50***	9.02	5.78***	7.27
6.	Pump set	4.75***	3.98	0.008	0.012
7.	FFS*	4.75***	3.98	0.85	0.82
8.	POP[a]	5.00***	6.04	1.3	1.29
R^2		0.77		0.63	
Adj R^2		0.72		0.55	

Note: (1) *FFS – Farmers field school, (2) ***indicates significance at 1 per cent level, (3) a POP- Package of practices.

The dummy variable regression model gave some interesting and useful results from policy point of view on the impact of NFSM programmes on the productivity of paddy. The non-beneficiaries realised an average yield of 20.25 quintals per acre as shown by the intercept. The beneficiaries under NFSM realised an additional yield of 8.75, 3.98 and 6.04 quintals per acre by adopting SRI method, receiving training under FFS and adopting entire PoP of paddy, respectively, over the non-beneficiary farmers (bench mark). The beneficiaries who adopted SRI method under NFSM realised 28.75 quintals, which represents an additional yield of 8.75 quintals over non-beneficiaries (20.25 quintals). Several research studies also reiterate the yield augmenting impact of SRI method of paddy cultivation (Reddy *et al.*, 2005; Basavaraja *et al.*, 2008; Rama Rao, 2011; Haldar *et al.*, 2012). A study by Reddy *et*

al. (2005) in Andhra Pradesh showed that SRI method of paddy cultivation yielded an incremental output of 6.58 quintals per acre over the normal method. An in-depth study by Haldar *et al.,* (2012) in West Bengal revealed that farmers realised an incremental yield of 4.96 quintals of paddy under SRI method. Further, farmers who received training under the FFS programme realised an additional yield of 3.98 quintals per acre and farmers who had adopted entire package of practices obtained an additional yield of 6.04 quintals per acre over and above non-NFSM farmers. In view of impressive positive impact of SRI, FFS and package of practices on paddy yield, the extension agency in the state needs to focus on the popularisation of these three practices and technologies in their upscaling efforts. Reorientation of NFSM programmes by focussing on the three components could substantially contribute to the achievement of additional 10 million tonnes of rice production as envisaged by the NFSM.

Results of Dummy Variable Regression Analysis for Sakaleshapura Taluk

In Sakaleshapura taluk, the non-beneficiaries realised an average yield of 12.20 quintals per acre (Table 6). However, only the variable SRI method of paddy cultivation was statistically significant with an estimated value of 5.78 and all other variables were non-significant. This implies that the adopters of SRI method of paddy cultivation under NFSM realised an additional yield of 5.78 quintals per acre over and above 12.20 quintals of non-beneficiaries. The coefficient of determination (R^2) was 0.63 revealing that 63 per cent of the variation in the paddy yield was explained by the explanatory variables included in the model. In general, yields in Sakaleshapura taluk were lower than that of Hassan taluk for the reasons explained earlier. Therefore, the impact of NFSM programmes was not fully manifested in increasing paddy yield. Nevertheless, the beneficiaries realised higher paddy output than non-beneficiaries. By and large, results clearly revealed that by adopting the NFSM interventions, farmers realised significant amount of additional yield reiterating the positive impact of NFSM on yield and incomes of farmers.

(f) *Employment Generation in Paddy due to NFSM*

Paddy crop generates a considerable magnitude of employment in its cultivation. On an average the employment creation ranged between 59 and 62 man-days per acre. With the adoption of NFSM interventions/technologies, the paddy cultivation will be highly intensive paving the way for additional employment generation. The adoption of recommended technologies requires higher labour input and concomitantly higher yield of paddy, which ultimately result in higher employment generation. As presented in Table 7, in Hassan taluk, the beneficiaries employed 15 per cent more labour than non-beneficiaries. In absolute terms, beneficiaries employed 61 man-days as against 53 man-days per acre among non-beneficiaries,

creating an additional employment of 8 man-days per acre. Among all farm operations, land preparation (44.51 per cent), and harvesting, threshing, bagging and transportation (22 per cent) contributed most to the incremental employment. However, FYM and irrigation operations absorbed lower labour among the beneficiary farmers.

TABLE 7. LABOUR USE PATTERN IN PADDY PRODUCTION IN THE STUDY AREA (MAN-DAYS)

		Hassan taluk				Sakaleshapura taluk			
Sl.No.	Operation	NFSM farmers	Non-NFSM farmers	Absolute difference	Percent change	NFSM farmers	Non-NFSM farmers	Absolute difference	Percent change
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1.	Nursery preparation	3.19	2.86	0.33	11.54	3.57	3.23	0.34	10.53
2.	Land preparation	6.85	4.74	2.11	44.51	6.43	3.41	3.02	88.56
3.	Transplanting	12.47	10.59	1.88	17.75	13.07	14.24	-1.17	-8.22
4.	FYM and fertiliser application	4.36	4.83	-0.47	-9.73	3.81	3.57	0.24	6.72
5.	Weeding	10.52	10.51	0.01	0.10	10.63	10.73	-0.1	-0.93
6.	Irrigation	4.56	4.89	-0.33	-6.75	3.81	3.38	0.43	12.72
7.	Harvesting, threshing, bagging and transportation	19.65	16.12	3.53	21.90	18.56	15.43	3.13	20.29
8.	Total labour employed	61.58	53.54	8.04	15.02	59.88	53.99	5.89	10.91

In Sakaleshapura taluk, the beneficiary farmers employed 6 additional man-days of labour over non-beneficiaries. The beneficiaries used 88.56, 20.29, and 12.72 percent of higher labour to take up farm operations of land preparation, harvesting, threshing, bagging and transportation and irrigation compared to the non-beneficiary farmers. However non-beneficiaries used 8.22 per cent higher labour than the beneficiaries to take up transplanting operation. By and large in both the taluks, adoption of NFSM recommendations created additional employment due to intensive nature of paddy cultivation. Hence, it can be inferred that NFSM has not only enhanced the productivity of paddy and incomes, but also resulted in additional employment generation.

(g) *Non-Economic Impacts of the NFSM Programme in the Study Region*

Though increasing paddy productivity was the primary objective of NFSM, it has also impacted the mindset of farmers positively as revealed by them. For example, soil acidity is a major problem in realising higher productivity in high rainfall areas especially in Sakaleshapura taluk. Hence, lime was recommended for rectification of this problem. Farmers in the study area successfully addressed the problem through application of lime to paddy lands. This was corroborated by the large scale lifting of lime stocks by farmers from the *Raitha Samparka Kendra* [Farm Communication Center, (RSK center)] for correction of acidic paddy lands.

Some of the RSKs introduced machinery and equipment such as paddy transplanter, cono-weeder and other machinery to farmers through co-operative arrangements. This has not only created large scale awareness about benefits of farm machinery and equipment in paddy production, but also increased the confidence of farmers in paddy production in the light of labour shortage. Due to use of transplanter and adoption of SRI method, there was substantial savings on the seed cost as planting of single seedling was gaining popularity. Therefore, farmers in the study region had positive attitude towards the NFSM programme in general.

IV

CONCLUSION

In paddy production in both the study taluks, the beneficiaries had used higher quantities of inputs, FYM and fertilisers which could be attributed to the improved knowledge of scientific cultivation of paddy acquired by beneficiaries under NFSM. This manifested in comparatively higher yield realisation by the beneficiaries over non-beneficiaries in both the taluks. The beneficiaries were cost effective in paddy production as their cost of production and cost incurred per unit of additional yield were lower than non-beneficiaries. It was also observed that a considerable magnitude of additional employment was created in paddy production under NFSM programmes. NFSM farmers realised higher net income from paddy cultivation over non-NFSM farmers. Further, non-material input technologies of SRI and FFS resulted in higher net incomes than material input use regime and non-NFSM scenario, highlighting the importance of these two technologies. Therefore, greater efforts may be initiated to upscale NFSM programmes focusing on SRI method of cultivation, FFS concept and package of practices to cover larger area to achieve the programme objectives. In this endeavour, some constraints faced by the implementing agency have to be seriously considered by the State Department of Agriculture. We wish to highlight one practical constraint faced by the field staff of the State Department of Agriculture which is implementing NFSM along with other programmes of the department. Farmers were unable to distinguish clearly NFSM programmes from other programmes. Further, the field staff has to implement many programmes of the department, hence, they may not be able to dedicate their time for effective implementation of the programme. Hence, with a view to giving undivided attention the personnel implementing the programme should be exclusively earmarked for this programme for better results.

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