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Agricultural Economics Research Review
Vol. 22 (Conference Number) 2009 pp 431-442

Rice Production in India — Implications of Land Inequity and Market Imperfections[1]

P. A. Lakshmi Prasanna*, Sant Kumar and Aruna Singh
National Centre for Agricultural Economics and Policy Research
Dev Prakash Shastri Marg, Pusa, New Delhi - 110 012

Abstract

The relationship between farm productivity and farm structure has been analyzed focusing mainly on one channel of transmission of this relationship, viz. input-use pattern in rice production. The hypothesized relationship tested in this study is that land inequality influences access to/ use of resources in rice production and in-turn influences productivity. Market imperfections aggravate the negative effect of land inequity on productivity. Results have shown that smallholders' share in inputs like fertilizers, and irrigation has increased over time, but a large number of smallholders still do not have access to these resources. Study has demonstrated that policies like fertilizer subsidy, agricultural credit, and minimum support prices are able to address market imperfections only partially. Hence, for improving productivity and profitability of rice production of smallholders in particular and other farmers in general, addressing of structural inequity needs attention besides a focus on technology development.

Introduction

Following the observation that 'productivity of farm sector is partly a function of farm structure' (Edward, 1985), a number of studies have been conducted focusing on technology, farm structure and productivity. Kim *et al*. (2005) have studied the simultaneity of technology, productivity and farm structure. Vollrath (2007) has focused on direct effect of land inequity on productivity in agriculture. Meanwhile some studies have argued that asset inequality *per se* is not a problem, but it is the combination of asset inequality and market failures that leads to negative effect on growth. Easterly (2007) has distinguished between structural inequality and market inequality and has argued that structural inequality is unambiguously bad, but market inequality has ambiguous effects. Further, inequality affects growth that in-turn strengthen processes that aggravate and reproduce inequalities (Wheeler, 2004). Other studies have emphasized that inequality in asset holding causes inequality in access to other production resources (Chopra, 1984; 1986; Easterly, 2007; Wheeler, 2004). Thus, inequality breeds inequality, affecting the overall productivity of the economy. In a recent study, Nayak (2009) has observed that inequity in distribution of land across states in India has led to inequity in distribution of accessibility to minor and groundwater irrigation resources. Keeping above observations in view, the present study has looked into the following issues: (i) whether structural inequality (specifically land size) has led to lower input-use by smallholders over time, and consequently, to their lower productivity and profitability as compared to other farmers in paddy production?. If yes, what are the market imperfections that have caused inequality in input-use pattern? If not, what are the policies that helped in addressing market imperfections and helped in checking the phenomenon 'inequality breeds inequality'?

Most of the above-noted studies have focused on the farm sector as a whole. But, the present study differs

* Author for correspondence,
Email: lakshmi@ncap.res.in

[1] This paper is derived from the research project on '*Smallholders in Indian Agriculture: Past, Current Status and Future*', funded by NCAP, New Delhi. The authors are grateful to Dr P K Joshi, former Director, NCAP, for his valuable guidance in conducting the research study.

from those in focusing on single crop cultivation, i.e. paddy. This assumes importance in the context of observations made by Miljkovic (2005) that grain-farming regions have lower degree of farm-size inequality than livestock or fruits and vegetables regions. The present study has focused on grain (paddy) farms in different regions of India instead of grain-farming regions, and is expected to yield interesting insights.

Data and Methodology

This study has used secondary data collected from various published sources, viz. input data on fertilizer use, irrigation facility, area under high-yielding varieties (HYVs) by farm-size, etc. were taken from various volumes of the *Input Surveys* published by the Directorate of Economics and Statistics, Ministry of Agriculture, Government of India (GOI), and the unit level data were taken from NSS report (59th round) on *Situation Assessment Survey of Farmers*. The paddy/ rice production data were taken from '*Handbook of Statistics on Indian Economy'*, a publication of the Reserve Bank of India. In this paper, rice/ paddy has been used interchangeably. Other data like state specific fertilizer quantity recommended for rice cultivation was taken from '*Handbook of Agriculture'*, a publication of the Indian Council of Agricultural Research, New Delhi, and fertilizer subsidy data from various issues of *Economic Survey* published by the Ministry of Finance, Govt. of India, New Delhi.

The analytical measures like simple tabular analysis, growth rate, and fertilizer imbalance index were applied to evaluate accessibility and use of production resources by smallholders versus other farmers. Regression approach was adopted in analyzing relation between land inequity and productivity. In this study 'farmers with operational holdings of size below 2 hectares' have been defined as 'smallholders'. To make data comparable, newly formed states, viz. Jharkhand, Chhattisgarh, and Uttarakhand were combined with their original states from which they were carved out, viz. Bihar, Madhya Pradesh and Uttar Pradesh, respectively.

While analyzing the use of fertilizers, inequity in quantity alone will be misleading, as it is the balanced fertilization that affects crop yield largely. Hence, fertilizer imbalance index was estimated adopting the approach followed by Mehta (2007). The formula applied for computing fertilizer imbalance index is given in Equation (1):

$$I = \sqrt{\frac{\{(N_a - N_n)^2 + (P_a - P_n)^2 + (K_a - K_n)^2\}}{3}} \quad \ldots(1)$$

where, I is the fertilizer imbalance index, measured as deviation in proportion of actual use of N, P and K to the recommended dosage. Subscripts 'a' and 'n' indicate actual and recommended proportions. The value of I away from zero measures the magnitude of imbalance in fertilizer-use. The consumption of fertilizers per ha is computed based on the area treated with fertilizers.

Results and Discussion

This section elaborates three major issues, viz. performance of rice production, fertilizers' consumption pattern and contributing factors, and productivity and profitability of smallholders versus other farmers.

Trends in Rice Area, Production and Productivity

Rice is one of the important food crops cultivated in India. Its production in 2008-09 is estimated to be 99.15 million tonnes. During triennium ending 2005-06, the major rice producing states in the country were: West Bengal (17 per cent), Uttar Pradesh (12.6 per cent), Andhra Pradesh (11.7 per cent), Punjab (11.5 per cent), Orissa, Madhya Pradesh and Bihar (7.5 per cent each). These seven states together accounted for about 75 per cent of total rice production in the country.

Indian agriculture continued to be dominated by smallholders, and rice is no exception. At all-India level, smallholders' share in rice area was 56 per cent in 2001-02, which has increased from 46 per cent in 1981-82. Within smallholders' crop portfolio, rice area share fluctuated between 33 and 39 per cent during the above period. What has happened to rice area operated by smallholders and other farmers across major states during the study period? This issue has been analyzed in detail.

During 1981-82 to 2001-02, growth in rice area operated by smallholders increased at the rate of 1.43 per cent annually at all-India level (Table 1). It was negative (-0.59 per cent) for other farmers and a meager (0.34 per cent) increase for all-size groups. Analysis has shown that across farm-size categories,

Table 1. Annual growth rate of area, production and yield of paddy during 1981-82 to 2001-02

(per cent)

States	Growth rate of area									Growth in production	Growth in yield
	Small holders			Other farmers			All farmers			All farmers	
	I	UI	T	I	UI	T	I	UI	T		
Andhra Pradesh	2.74	0.00	2.53	-0.74	0.26	-0.69	0.91	0.11	0.86	2.24	2.24
Assam	-1.36	-0.61	-0.66	0.19	2.02	1.87	-0.66	0.34	0.28	3.62	2.70
Bihar	2.13	2.69	2.48	-2.87	-1.92	-2.25	-0.75	-0.12	-0.34	3.65	4.57
Gujarat	-4.94	-4.98	-4.96	-4.94	-4.95	-4.95	-4.94	-4.96	-4.95	0.59	0.14
Haryana	19.38	-1.19	18.43	5.93	-3.46	5.28	7.72	-3.26	7.00	5.88	0.35
Karnataka	3.28	1.54	2.53	0.37	-0.47	0.04	1.41	0.32	0.97	1.85	0.64
Kerala	-3.57	-4.18	-3.95	-4.05	-4.39	-4.24	-3.75	-4.24	-4.05	-2.33	1.68
Madhya Pradesh	8.59	8.67	8.65	1.41	0.82	0.90	3.32	2.35	2.49	3.46	2.07
Maharashtra	0.63	4.26	3.50	-2.21	-0.29	-0.72	-1.28	1.30	0.73	0.44	0.45
Orissa	4.52	1.03	1.75	0.51	-1.57	-1.14	2.19	-0.48	0.08	4.28	3.58
Punjab	3.09	-	3.09	6.95	1.83	6.94	6.56	2.59	6.56	6.78	1.01
Tamil Nadu	-0.37	0.61	-0.30	-1.93	-2.75	-2.02	-1.04	-1.28	-1.06	0.79	2.05
Uttar Pradesh	19.63	-2.11	4.08	9.74	-2.74	2.29	15.14	-2.32	3.41	6.73	4.89
West Bengal	13.27	-0.24	3.00	1.31	-3.16	-1.94	8.47	-1.29	1.17	8.08	6.23
All- India	4.26	-0.49	1.43	0.80	-1.65	-0.59	2.35	-1.10	0.34	3.76	3.00

Note: I = Irrigated, UI = Un-irrigated, T= Total

Source: Input surveys

growth in rice area cultivated without irrigation was negative at all-India level, while the growth in rice irrigated area was observed very high on smallholders (4.26 per cent) as compared with other farms (0.80 per cent). The increased growth in rice area operated by smallholders can be viewed as increasing marginalization of farm holdings. Continuing of this trend will have several policy implications in terms of sustenance, efficiency of farms, evolving system to resource sharing, etc. and needs further research on these aspects.

At the state level, analysis has revealed that growth in non-irrigated rice area operated by other farmers was negative in majority of states, with the exception of Andhra Pradesh, Assam, and Madhya Pradesh (mainly Chhattisgarh) and Punjab, the so called traditional rice growing states. Positive growth in non-irrigated rice area in these states can be viewed as a major food crop with almost no choice to replace it. Further, growth in rice area operated by smallholders both under the irrigated and non-irrigated conditions was positive in the majority of states during 1981-82 to 2001-02. Moreover, under the irrigated condition, very high growth in smallholder's rice area was noticed in Uttar Pradesh, Haryana, West Bengal, Madhya Pradesh, Karnataka and Punjab. This trend reflects marginalization of holdings due to sub-division and fragmentation of holdings and land reforms. Apart from area, the growth in rice production at all-India level was 3.76 per cent and was mainly contributed by yield growth (3.00 per cent). Also, states like Haryana, Orissa, Punjab, Uttar Pradesh and West Bengal have performed better as compared to all-India figure of production. This was mainly led by growth in yield in the case of Orissa, Uttar Pradesh and West Bengal and by growth in area in the case of Haryana and Punjab.

How smallholders have performed in rice production over time? This issue has been analyzed in this section, with particular reference to smallholders' share in total rice area. Analysis has revealed that share of smallholders in both total rice and irrigated rice area has increased with time and across states, except in Assam, Gujarat and Punjab (Table 2). The maximum change has been recorded in West Bengal, and it has been attributed to land reform operations followed in the state. Also, highest growth in rice yield (6.23 per cent) was recorded in West Bengal. In other states, the progress is slow.

Table 2. Share of smallholders in paddy area across states in India over years: 1981-82 to 2001-02

(per cent)

States	1981-82		1986-87		1991-92		1996-97		2001-02	
	I	T	I	T	I	T	I	T	I	T
Andhra Pradesh	48	48	51	50	54	53	57	57	62	62
Assam	55	63	NA	NA	42	45	47	55	46	52
Bihar	42	40	51	48	56	52	NA	NA	NA	NA
Gujarat	32	30	29	31	34	31	33	33	32	25
Haryana	13	13	23	23	25	25	28	28	25	25
Karnataka	36	37	41	40	44	43	42	42	46	47
Kerala	63	67	67	71	72	68	68	70	72	74
Madhya Pradesh	27	21	30	23	34	25	40	33	43	37
Maharashtra	33	34	36	36	43	41	NA	NA	50	51
Orissa	42	42	46	44	53	50	57	54	55	56
Punjab	10	10	10	11	11	11	9	9	7	7
Tamil Nadu	57	56	56	56	64	64	68	68	66	66
Uttar Pradesh	55	63	54	60	60	60	64	64	67	68
West Bengal	60	63	64	66	69	70	73	74	81	82
All-India	45	46	46	47	50	48	54	53	56	56

Note: I= Irrigated, T= Total, NA= Not available

Source: Input surveys

With the structural change, there was associated change in rice area treated with fertilizers across size-groups at all-India level. During 1981-82 to 2001-02, the share of rice area treated with fertilizers under irrigated condition increased by nearly 10 per cent across farm-size categories (Table 3), while under non-irrigated conditions, it increased between 20 and 25 per cent at all-India level. Although fertilizers-treated area share increased more under non-irrigated conditions, still data confirm prominent role of irrigated environment in increasing the fertilizer use. It is evident from the fact that growth in rice area treated with fertilizers under irrigated conditions increased at the rate of 5.3 per cent on smallholders and about 1.60 per cent on other farms. Similarly, growth in fertilizer consumption on smallholders' irrigated area was about 14 per cent and nearly 6 per cent on other farm categories.

Fertilizers Consumption and Contributing Factors

Role of irrigation and input-responsive high-yielding varieties (HYVs) in increasing production and productivity is well established. How these and other factors affect fertilizers application? This issue has been analyzed with respect to rice production and has been presented in this section.

The data has shown that fertilizers use varied widely on both smallholders and other farms (Table 4). It is more prominent with HYVs and irrigated conditions over other varieties and non-irrigated conditions. Further, rice area under HYVs across all farm-sizes is above 90 per cent in irrigated conditions and 50-70 per cent in non-irrigated conditions. Fertilizers use in HYVs of rice under irrigated condition was 179 kg/ha on smallholders farms, while on other farms it was 163 kg/ha in 2001-02. The similar trends are observed both for other varieties and non-irrigated conditions. Therefore, it can be inferred that HYVs and irrigation facilities are the driving factors in increasing use of fertilizers in rice.

The smallholders' share of irrigated rice area increased from 45 per cent to 56 per cent at the country level during 1981-82 to 2001-02 (Table 2). Their share in HYVs area increased from 53 per cent to 58 per cent during 1996-97 to 2001-02. Beside these factors, the policy on fertilizer subsidy and minimum support prices for rice contributed to the increased adoption of fertilizers. The share of smallholders in getting institutional short-term credit reached 50 per cent by

Table 3. Paddy area treated with fertilizers and growth in area treated and fertilizers applied

(per cent)

Years	Smallholders' farms			Other farms			All farms		
	I	UI	Total	I	UI	Total	I	UI	Total
1981-82	86	41	60	84	36	56	85	38	58
1986-87	81	46	61	83	40	59	82	43	60
1991-92	90	56	71	90	44	63	90	49	67
1996-97	89	52	74	88	46	70	88	49	72
2001-02	96	65	83	95	54	77	96	60	81
Growth rate during 1981-82 to 2001-02, %									
Paddy area treated with fertilizers	5.30	2.09	3.97	1.60	0.11	1.06	3.28	1.12	2.45
Fertilizer applied	13.81	9.44	12.58	5.57	5.07	5.47	9.25	7.48	8.82

Note: I= irrigated, UI = un-irrigated
Source: Input surveys

Table 4. Fertilizers applied in various environments of rice production in the country

(kg/ha)

Years	Smallholders' farms		Other farms		All farms		Share of HYVs in total treated area		
	HYVs	Other varieties	HYVs	Other varieties	HYVs	Other varieties	Smallholders' farms	Other farms	All farms
Irrigated condition									
1996-97	172	124	156	102	165	115	91	92	91
2001-02	179	145	163	112	172	131	94	94	94
Non-irrigated condition									
1996-97	113	74	85	60	100	68	51	49	50
2001-02	116	92	102	69	111	81	74	65	70
Overall condition									
1996-97	161	90	144	73	153	82	79	80	80
2001-02	161	108	149	81	156	95	88	86	87

Source: Input surveys

2001-02 and disbursement of loan in kinds also helped increased fertilizer consumption by smallholders. These observations corroborate with the findings of AERC (2008), FAO (2005), and Expenditure Reforms Commission Report on rationalizing fertilizer subsidy in India. But, the few worrying facts that remained during 1986-87 and 2001-02 were: (i) Of the total smallholders, only 17 per cent were able to access institutional short-term credit, (ii) Smallholders' share in total holdings constituted 76 per cent and their share in institutional loan was only 49 per cent in 1986-87. In 2001-02, the smallholders' share in total holdings stood at 81 per cent, but their share in credit was only 50 per cent.

Within smallholders' portfolio, the share of paddy in fertilizer consumption fluctuated between 38 per cent and 44 per cent during 1981-82 and 2001-02. When we considered the total fertilizer consumption in rice, smallholders' share increased from 47 per cent in 1981-82 to 60 per cent in 2001-02. Accordingly, their share in fertilizer subsidy increased and matched with smallholders' share in rice treated area and total rice area (Table 5). This is in line with the observations recorded in early studies (Acharya and Jogi, 2004; Singh, 2004). Has this increase caused an imbalance use of fertilizers? This issue has been analyzed for the important rice-growing states applying state-specific recommended dosages for rice production and the results have been presented in Appendix 1. It was

Table 5. Fertilizer use and its subsidy to smallholders and other farms in rice production: 1981-82 to 2001-02

Years	Fertilizers used (kg/ha)	Share in fertilizers used, %	Yield (kg/ha)	Subsidy on gross cropped area basis			Subsidy on treated area basis		
				Rs/ha	Rs/kg fertilizers	Rs/ q of output	Rs/ha	Rs/kg fertilizers	Rs/ q of output
Smallholders									
1981-82	79	47	1308	33	0.42	2.55	56	0.71	4.28
1986-87	111	49	1471	157	1.42	10.68	259	2.33	17.58
1991-92	118	51	1751	393	3.33	22.44	550	4.66	31.40
1996-97	146	57	1882	695	4.76	36.94	940	6.44	49.96
2001-02	155	60	2079	1026	6.62	49.37	1234	7.96	59.36
Other farmers									
1981-82	80	53	1308	33	0.41	2.49	58	0.72	4.43
1986-87	105	51	1471	146	1.39	9.93	248	2.36	16.86
1991-92	121	49	1751	351	2.90	20.06	560	4.63	31.99
1996-97	130	43	1882	584	4.49	31.04	835	6.42	44.38
2001-02	139	40	2079	868	6.24	41.74	1120	8.05	53.85

Source: Input surveys

evident that (i) In all the years fertilizer imbalance index was lower on smallholders than other farmers, a few exceptions being Assam (in 1996-97 and 2001-02), Punjab (in 1981-82 and 1986-87) and Kerala (in 1986-87). (ii) In 1981-82, fertilizers imbalance index in the case of smallholders was highest in Uttar Pradesh, followed by Gujarat. Ironically in Uttar Pradesh, per ha fertilizers-use in 1981-82 was lower than the national average. (iii) In 2001-02, the imbalance index on smallholders was highest in Gujarat, followed by Haryana. During the year, per ha fertilizer consumption was lower in the case of Gujarat, and higher in the case of Haryana than the national average. These findings indicate that fertilizer imbalance can occur in case of both lower and higher levels of fertilizer use.

The above analysis provides answers to the questions like: (i) whether smallholders are getting their due share in fertilizers consumption of a state? (ii) Whether they are able to carry out a balanced fertilizer application? But whether the share of state in total fertilizer consumption in paddy is matching with its share in paddy area of the country? Is this matching has any implication on fertilizers-use by smallholders and fertilizer imbalance index? These questions assume importance in the context of observations made by Karnik and Lalvani (1996) that there is a bias in allocation of fertilizers towards states with large holdings and in-turn, fertilizer subsidies between states. Results of analysis carried out to look into these issues have been presented in Tables 6 and 7.

It has been found that Haryana (high matching ratio, and high imbalance index), Karnataka (high matching ratio, and low imbalance index), Madhya Pradesh (low matching ratio, and high imbalance index), and Orissa (low matching ratio, and low imbalance index), have consistently maintained their positions in both the years, (ii) Punjab moved from high matching ratio and low imbalance category to high matching ratio and high imbalance category, and (iii) Kerala and West Bengal even under the condition of improvement in fertilizer availability maintained a lower fertilizer imbalance index (Table 6). These kinds of situations are arising because of differences between the shares of total rice area and rice area treated with fertilizers. When more fertilizer is available and is spread over more treated area (share of treated area is more than share of paddy area), low fertilizer imbalance index results. In 1981-82, only in the states of Andhra Pradesh, Haryana and Tamil Nadu, the share of fertilizer treated area in total rice area of smallholders was above 80 per cent. In 2001-02, in the states of Assam, Gujarat, Madhya Pradesh and Orissa, the share of fertilizer treated area in total rice area of smallholders was below 80 per cent and in all these states the matching ratio was low, indicating lower fertilizer availability.

Table 6. Estimates of fertilizer imbalance index on smallholders: 1981-82 and 2001-02

Matching ratio (share of fertilizer to paddy area of state in the country)	Fertilizer Imbalance Index of Smallholders	
	High (> 0.1)	Low (< 0.1)
1981-82		
High (>1)	Andhra Pradesh, Gujarat, Haryana, Maharashtra, Tamil Nadu	Karnataka, Kerala, Punjab
Low (<1)	Assam, Bihar, Madhya Pradesh	Orissa, Uttar Pradesh, West Bengal
2001-02		
High (>1)	Haryana, Punjab	Andhra Pradesh, Karnataka, Tamil Nadu
Low (<1)	Gujarat, Madhya Pradesh	Assam, Maharashtra, Orissa, Uttar Pradesh
Perfect matching (=1)		Kerala, West Bengal

Table 7. Share of area treated with fertilizers in total rice area of smallholders across states: 1981-82 to 2001-02

(per cent)

States	1981-82	1986-87	1991-92	1996-97	2001-02
Andhra Pradesh	97	96	94	96	99
Assam	7	NA	12	21	25
Bihar	75	75	78	NA	NA
Gujarat	67	75	85	81	77
Haryana	88	92	88	91	99
Karnataka	65	78	87	87	92
Kerala	78	86	92	92	86
Madhya Pradesh	29	33	54	53	59
Maharashtra	62	69	73	NA	89
Orissa	24	32	54	71	69
Punjab	76	88	86	99	99
Tamil Nadu	93	81	94	99	95
Uttar Pradesh	73	50	73	73	94
West Bengal	44	57	74	75	86
All-India	60	61	71	74	83

Note: NA = Not available

Source: Input surveys

Productivity and Profitability of Smallholders vis-à-vis other Farmers

Given the lower fertilizer imbalance index in the case of smallholders, a better productivity is expected. This issue was analyzed using NSS unit level data (59th round) on situation assessment survey of farmers. Here, the categorization of farmers was based on rice area, and not on the total operational area. Data showed that rice yield was higher on smallholders' farms than other farms across states during 2002-03 (Table 8).

Further, rice yield of smallholders in states like Assam, Bihar, Gujarat, Karnataka, Orissa, Uttar Pradesh and West Bengal was 3-4 times higher than other farmers. Despite higher productivity on smallholder farms, marketed surplus was less with them. This leads to inference that smallholders' direct contribution to food security (in terms of supply of paddy) of the overall population was less over their own food-security. But, they contribute indirectly to food security of the overall population, as their demand for outside rice will be less. However, with further improvement in yield, smallholders can contribute to food security both directly and indirectly. It may also have impact on lowering rice prices, and making it accessible to others, provided minimum support price

Table 8. Yield and marketable surplus of rice production across farm-size and major states of India

States	Yield (kg/ha)			Marketed surplus (%)		
	Smallholders' farms	Other farms	Total farms	Smallholders' farms	Other farms	Total farms
Andhra Pradesh	3751	3542	3670	67	78	71
Assam	3992	1083	3406	27	54	28
Bihar	3391	1079	2804	23	37	24
Gujarat	2094	733	1478	61	78	65
Haryana	5477	3895	4315	95	96	96
Karnataka	3659	607	2282	52	74	55
Kerala	2811	1961	2694	55	92	59
Madhya Pradesh	1706	1702	1704	25	37	32
Maharashtra	2178	1511	1860	38	55	45
Orissa	2530	923	2018	14	33	17
Punjab	7357	6482	6632	97	97	97
Tamil Nadu	2875	2758	2841	64	85	70
Uttar Pradesh	2936	1049	2542	36	72	39
West Bengal	4806	1031	4223	48	42	48
All-India	3737	1647	3047	41	80	48

Source: GOI(2005) NSSO situation assessment survey of farmers

policy works well. Low share of marketable surplus with smallholders also assumes significance in the context of arguments of tradeoff between policies of fertilizer subsidy and minimum support price.

The analysis of profitability on smallholders versus other farmers from rice production revealed that the ratio of average farm-size of smallholders to other farmers was less than the ratio of smallholders per holding profit to other farmers in majority of paddy growing states, except Tamil Nadu (Table 9). Further average farm-size of smallholders was highest in Punjab, followed by Haryana. But, share of smallholders in different states according to situation assessment survey data have been presented in Table 10.

The smallholders' share in rice production was found higher than their share in area across states and at all-India level. In contrast, their number share was higher than share in paddy area. Hence in the case of paddy, adverse effects of structural inequality with respect to fertilizer-treated area and fertilizer consumption are being addressed to some extent by addressing market failures by way of fertilizer subsidy. In 2001-02, despite all this, about 10 per cent of total paddy area operated by smallholders remained untreated with fertilizers. An equal share of another 10 per cent of rice area operated by other farmers remained untreated with fertilizers. If this 20 per cent rice area has been treated with fertilizers, it would have resulted in the overall increase in production and profitability of economy. The efficiency of fertilizers availability can be improved by allocating fertilizers share across states, increasing irrigated area on smallholders, and increasing their share in institutional credit. Regarding fertilizer subsidy, the Expenditure Reform Commission has suggested a dual pricing system, whereas in the Union Budget 2009-10 of India, nutrient-based subsidy system was announced.

Land Inequity and Productivity

The analysis of impact of land inequity on paddy productivity, presented in Table 11, clearly indicated that (i) land inequity affects the productivity negatively, and (ii) average size of holding influences the productivity positively. Among the channels through which land inequity influence productivity, the input use pattern is one as discussed earlier. Hence besides technology, improvement in land equity, as brought out through regression results, could also be viewed as important issue for improving productivity in agriculture.

Table 9. Per holding returns of smallholders versus other farms

States	Average size of holding, ha			Ratio of smallholders to other farmers in			
	Smallholders' farms	Other farms	Total farms	Average holding size	Per holding expenses	Per holding output value	Per holding profit
Andhra Pradesh	0.54	3.29	0.80	0.164	0.162	0.165	0.169
Assam	0.63	2.74	0.75	0.230	0.278	0.831	1.133
Bihar	0.50	3.27	0.64	0.153	0.252	0.483	0.841
Gujarat	0.59	4.25	0.97	0.139	0.145	0.482	-5.224
Haryana	0.83	4.02	1.99	0.207	0.170	0.259	0.456
Karnataka	0.60	3.22	0.94	0.185	0.384	1.148	11.486
Kerala	0.33	3.44	0.38	0.097	0.127	0.138	0.158
Madhya Pradesh	0.66	3.50	1.26	0.190	0.150	0.191	0.227
Maharashtra	0.56	3.50	0.93	0.159	0.171	0.222	0.291
Orissa	0.58	2.92	0.78	0.198	0.252	0.537	4.183
Punjab	0.96	4.49	2.76	0.214	0.208	0.239	0.264
Tamil Nadu	0.58	3.84	0.76	0.150	0.173	0.141	0.106
Uttar Pradesh	0.45	3.15	0.55	0.142	0.197	0.337	0.798
West Bengal	0.40	2.79	0.46	0.142	0.254	0.596	-2.674
All India	0.51	3.4051	0.71	0.150	0.170	0.334	0.687

Source: GOI(2005) NSSO situation assessment survey of farmers

Table 10. Some characteristics of smallholder paddy producers in various states of India

(per cent)

States	Farmers number	Area under rice crop	Production share	Receipts value	Expenses
Andhra Pradesh	91	61	63	61	61
Assam	95	80	94	94	83
Bihar	95	75	90	90	83
Gujarat	90	55	78	81	56
Haryana	64	27	34	31	23
Karnataka	87	55	88	88	72
Kerala	98	86	90	90	89
Madhya Pradesh	79	42	42	42	36
Maharashtra	87	52	61	60	54
Orissa	92	68	85	85	73
Punjab	49	17	19	19	17
Tamil Nadu	94	71	72	69	74
Uttar Pradesh	96	79	91	90	84
West Bengal	97	85	96	96	91
All India	93	67	82	81	70

Source: GOI (2005) NSSO situation assessment survey of farmers

Table 11. Impact of land inequity on paddy productivity

Particulars	Coefficients	Standard Error	t –statistics	P-value
Intercept	3.978	0.173	22.96	1.21E-10
Land gini per cent	-0.011	0.003	-3.05	0.010905
log of average paddy farm size	0.576	0.198	2.89	0.014533
Number of observations	14			
R square	0.507			
Adjusted R square	0.418			

Note: Dependent variable: log of paddy yield in different states

Conclusions and Policy Implications

The input-use pattern of smallholders vis-à-vis other farmers in paddy production has been analyzed in the study using secondary data collected from input surveys. The analysis has shown increasing share in the use of inputs like fertilizer, irrigation, and HYVs adoption on smallholders over years. This increasing share is facilitated by policies like fertilizer subsidy, minimum support price policy, agricultural credit policy and other agricultural policies. Still by 2001-02, about 17 per cent of rice area operated by smallholder remained untreated with fertilizers and a significant proportion of smallholders has not been able to have access to institutional credit. This implies that the existing policies are not conducive to address the market imperfections, thereby creating situation where structural inequity (more specifically land inequity) has a negative effect on agricultural productivity. It has been confirmed by the analysis of land inequity effects on rice yield. Since data are not available regarding the extent of leased-in/leased-out land in paddy specifically, the whole analysis has based on operational holdings and paddy area only. This can obscure the actual extent of inequity in land ownership. Given the limitation, the negative effect of land inequity on productivity has highlighted the need for attention on structural and market inequity issues.

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Appendix 1

State-wise fertilizer imbalance index in rice production: 1981-82 to 2001-02

States	Smallholder farms					Other farms					All farms				
	1981-82	1986-87	1991-92	1996-97	2001-02	1981-82	1986-87	1991-92	1996-97	2001-02	1981-82	1986-87	1991-92	1996-97	2001-02
Andhra Pradesh	0.15	0.18	0.14	0.11	0.06	0.37	0.41	0.35	0.28	0.19	0.15	0.18	0.14	0.11	0.06
Assam	0.20	NA	0.21	0.12	0.08	0.47	NA	0.48	0.08	0.07	0.21	NA	0.21	0.10	0.07
Bihar	0.20	0.18	0.18	NA	NA	0.39	0.41	0.33	NA	NA	0.20	0.19	0.18	NA	NA
Gujarat	0.27	0.19	0.19	0.09	0.25	0.48	0.47	0.45	0.31	0.47	0.25	0.19	0.19	0.10	0.21
Haryana	0.22	0.23	0.20	0.19	0.21	0.41	0.40	0.48	0.48	0.47	0.22	0.21	0.21	0.20	0.21
Karnataka	0.06	0.09	0.09	0.06	0.04	0.14	0.22	0.23	0.14	0.07	0.06	0.09	0.09	0.06	0.03
Kerala	0.04	0.06	0.06	0.05	0.08	0.05	0.03	0.20	0.15	0.23	0.04	0.05	0.07	0.05	0.08
Madhya Pradesh	0.26	0.24	0.20	0.19	0.15	0.26	0.25	0.20	0.19	0.16	0.26	0.25	0.18	0.18	0.15
Maharashtra	0.14	0.07	0.16	NA	0.06	0.25	0.11	0.31	NA	0.13	0.12	0.06	0.16	NA	0.06
Orissa	0.08	0.24	0.15	0.05	0.02	0.19	0.43	0.31	0.06	0.03	0.07	0.22	0.16	0.04	0.01
Punjab	0.08	0.12	0.11	0.11	0.12	0.07	0.11	0.11	0.12	0.13	0.07	0.11	0.11	0.12	0.13
Tamil Nadu	0.22	0.09	0.03	0.01	0.02	0.44	0.18	0.08	0.02	0.05	0.22	0.09	0.02	0.01	0.02
Uttar Pradesh	0.31	0.20	0.18	0.21	0.18	0.52	0.49	0.40	0.45	0.39	0.31	0.21	0.18	0.21	0.18
West Bengal	0.12	0.07	0.17	0.04	0.01	0.22	0.21	0.45	0.10	0.05	0.11	0.08	0.19	0.04	0.01

NA: Not available