Agricultural Economics Research Review
Vol. 19 July-December 2006 pp 219-236

Diversification and Its Impact on Smallholders: Evidence from a Study on Vegetable Production*

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Abstract

There is an emerging concern about the viability of small farm agriculture, particularly in the context of on-going process of globalization. It is contended that viability of small farms can be improved through diversification of agriculture into higher-value crops like fruits and vegetables. This paper has assessed the impact of diversification of agriculture towards vegetables on farm income and employment using household level information from the Indian state of Uttar Pradesh. The results clearly reveal that vegetable production is more profitable and labour-intensive, therefore it fits well in the small farm production systems. The smallholders are relatively more efficient in production and own more family labour in contrast to large farmers. Vegetable production is the emerging sector in agricultural diversification that would augment income of smallholders and generate employment opportunities in rural areas. Women are also benefited as the vegetable production engages relatively higher women labour in various operations. However, prevailing constraints do not allow smallholders to fully expropriate the emerging opportunities in vegetable production. Major constraints in vegetable production are lack of assured markets and a well-developed seed sector. Since vegetables are perishable in nature, lack of efficient marketing system and appropriate

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* The study is a part of collaboration between National Centre for Agricultural Economics and Policy Research, New Delhi, India and the International Food Policy Research Institute, Washington, DC, USA.

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The authors thank the anonymous referee for his useful suggestions.

infrastructure results in huge post-harvest losses. Further, non-availability of improved and good quality seeds reduces the profitability and increases production risk. Other important factors that restrict expansion of area under vegetables are higher price and yield risks as compared to cereals and low marketable surplus that increases transaction costs. The vegetable prices are highly volatile, which severely affect the profitability in the event of marginal increase in their supply. Low volume of marketable surplus also adversely affects the bargaining power of smallholders and thus results in realizing lower prices. The possible solution for overcoming this is through developing institutional arrangements that strengthen farm-firm linkages. Contract farming is one such arrangement that helps smallholders to overcome the constraints in vegetable production.

Introduction

Small landholders have dominated the Indian agriculture in the past, and the trend is likely to continue in future as well. It is estimated that small landholders would account for as much as 83 per cent of the total landholders by 2010-11, as compared to 63 per cent in 1960-61 and 81 per cent in 2000-01 (Jha, 2001). Accordingly, the average size of landholding also declined from 2.69 ha in 1960-61 to 1.55 ha in 1990 and to 1.34 ha in 2000-01. In case of small landholders, the average size is as low as 0.67ha. The viability and sustainability of such tiny holdings is doubtful, particularly in view of the on-going process of globalization.

The small landholders are poor, usually undernourished and poverty-stricken; and by and large practise subsistence agriculture with very limited marketable surplus. Their plight calls for urgent need to augment their income for ensuring food security and alleviating poverty. Experiences gained in other developing countries suggest that diversification of agriculture towards high-value commodities and creation of non-farm employment opportunities have helped small landholders to augment their incomes and bail them out of the vicious circle of poverty (Ryan and Spencer, 2001). The emerging opportunities in the changing economic environment need to be capitalized for the benefit of the small landholders. Factors such as rising per capita income, changing food consumption patterns, growing urbanization and globalization are pushing up demand for high-value commodities in both domestic and international markets and are creating opportunities for smallholders.

From smallholders' perspective, fruits and vegetables are important constituents of high-value agriculture. The rate of increase in production of fruits and vegetables is indeed impressive. The production of fruits increased from 28.63 million tonnes in 1991-92 to 43 million tonnes in 2001-02 and of

vegetables reached 88.62 million tonnes in 2001-02 from 58.63 million tonnes in 1991-92. And, the smallholders have contributed significantly to this rising production. In 2001, they contributed 55 per cent to the total production of fruits and vegetables, up from 51 per cent in 1991 and 43 per cent in 1970-71 (Singh *et al.*, 2002). The share of smallholders in production of fruits and vegetables is likely to go up further. Numerous studies indicate that farmers are gradually shifting towards high-value commodities, particularly fruits and vegetables. Studies also reveal that fruits and vegetables offer immense scope to increase income levels of smallholders and improve the productivity of scarce resources (Pingali and Rosegrant, 1995; Chand, 1996; Subramanian *et al.*, 2000; Joshi *et al.,* 2003).

With a view to take advantage of opportunities arising out of agricultural diversification, it is important to assess their utility for smallholders. The benefits of agricultural diversification to smallholders and the likely obstacles that may come in the way of substituting foodgrain crops with high-value commodities need to be assessed. The present paper has analysed these issues with the help of a case study on vegetables. The specific objectives of the study were to (i) quantify the impact of vegetable production on income and employment of smallholders, (ii) identify obstacles faced by smallholders in vegetable production, and (iii) assess opportunities through innovative institutions to overcome constraints in vegetable production. The study hypothesized that smallholders are more efficient in the production of commodities because of availability of own-labor in abundance but acute market inefficiencies due to extremely small marketable surplus and high transaction costs negate the advantage.

Methodology

(a) Definition of Smallholder

In India, a farmer is categorized as a smallholder if he owns land equal to or less than 2.0 hectares in size. However, size of land may not be the only criterion for categorizing farmers as smallholders. Narayanan and Gulati (2003) consider smallholder as a farmer (crop or livestock) practising a mix of commercial and subsistence agriculture or where the family provides most of the labour and the farm provides the principal source of income. They have noted that a considerable number of farmers who fit in this description, actually possess much less land and a smaller number of animals as compared to the regional averages. In this study, we have defined a smallholder as a farmer who owns or rents in land equal to or less than 2.0 hectares, is largely dependent on family labour and chooses a production

portfolio that meets his household food-security requirements and generates cash flow from commercial crops.

(b) Study Area and Sampling

The study was conducted in the western part of Uttar Pradesh. This region is considered to be the most progressive and is characterized by intensive and commercial agriculture, dominated by rice-wheat and sugarcane production systems, and is well endowed with efficient network of irrigation systems. The profitability from these crops is dwindling in the region (Joshi *et al*., 2003). The continued cultivation of these crops, particularly rice and sugarcane, is adversely affecting soil and water resources. The farmers in the region are now gradually diversifying towards vegetables, fruits and dairying due to their relative advantage of being in proximity to metropolis of Delhi, which provides a vast market for their produce. In this study, we have focused on production of vegetables by the smallholders.

The study is based on a primary survey conducted in 2002-03 by following three-stage sampling approach. At the first stage, three districts, viz. Bulandsahar, Gautam Budha Nagar and Ghaziabad were randomly selected. These districts are within the radius of 80 km from Delhi and are well connected with Delhi through road and rail. At the second stage, 25 villages were randomly selected from the group of these districts. And at the third stage, 178 vegetable farmers were randomly selected from the selected villages. The sample farmers had low schooling, and had large families with surplus labour and high dependency on agriculture for livelihood. Attempt has been made to collect information on all aspects of vegetable production and marketing for the year 2001-02.

Impact of Vegetable Production

In this section, the impact of vegetable cultivation on farmers' income and employment has been assessed. First of all, the production portfolio of smallholders has been compared with that of large farmers. The purpose of this section is to test twin hypotheses: (i) smallholders allocate relatively more area to vegetables, and (ii) vegetables yield higher dividends and generate greater employment opportunities than foodgrain crops.

(a) Production Portfolio and Smallholders

The production portfolio of the sample farmers is a mix of foodgrain crops and vegetables. The principal occupation of a majority of the farmers is cultivation of vegetables. Foodgrain crops are cultivated primarily to meet

Table 1. Share of major crop groups in area and value of output by farm size

(in per cent)

Crop group	Small farms (≤2 ha)		Medium farms (>2-4 ha)		Large farms (>4 ha)	
	Area	Value	Area	Value	Area	Value
Foodgrains	30.7	29.4	33.7	27.6	53.4	50.7
Vegetables	55.4	65.6	46.7	61.8	28.1	46.4
Other crops	13.9	5.0	19.6	10.6	18.5	2.9
All	100.0	100.0	100.0	100.0	100.0	100.0

Source: Derived from the survey conducted in the study area

the household food security needs. The sample households had allocated approximately 44 per cent of the total cultivated area to vegetables. Disaggregating the cropping pattern into groups according to size of landholding, it was observed that small farmers allocated a larger share (> 50 per cent) of land to vegetable production (Table 1). Smallholders allocated approximately one-third of the area to foodgrain crops to meet their food-security needs. On the other hand, large farmers allocated more than half of the total area to foodgrain crops. Interestingly, as the size of landholding decreased, the production portfolio shifted in favour of vegetables.

For smallholders, vegetable production was an important source of income. It accounted for 66 per cent share in the value of crop output. Among vegetables, potato, cauliflower and tomato contributed about 57 per cent. Large farmers also gained much from vegetable cultivation. With about 28 per cent of area under vegetable cultivation, they realized about 46 per cent in terms of value. Potato, cabbage and tomato accounted for about 66 per cent of the total value of vegetable production in the production portfolio of large farmers.

Detailed crop-wise production portfolio on different categories of farms is given in Table 2. Rice and wheat were the principal foodgrain crops and accounted for about 27 per cent of total cultivated area. There was a contrasting difference in the area allocated to rice and wheat by small and large farmers. While smallholders allocated about 22 per cent of their total cropped area to rice and wheat, it was as much as 48 per cent in the case of large farmers. It was further observed that large farmers preferred wheat, while smallholders favoured paddy. It was interesting to note that there was a positive relationship between the size of landholding and the share of wheat in cropping pattern. In the case of paddy, the converse was true. This can be explained as firstly, paddy is a labour-intensive crop, which gives comparative advantage to smallholders. Secondly, smallholders prefer

Table 2. Cropping pattern by farm size

(in per cent)

Crop	Farm size			All groups
	Small	Medium	Large	
Maize	6.42	6.08	3.89	6.12
Paddy	7.75	5.87	1.95	5.69
Wheat	14.15	17.78	45.98	21.46
Other cereals	0.75	2.35	0.61	2.11
Pulses	1.62	1.52	1.15	1.45
Oilseeds	0.86	0.30	neg.	0.26
Cash crops	7.42	10.07	13.00	9.65
Fodder crops	6.27	9.31	5.35	9.37
Vegetables	55.17	46.72	28.07	43.89
Break-up of vegetables				
Bottle gourd	3.67	5.43	0.18	3.63
Eggplant	0.96	0.58	0.44	0.82
Cabbage	2.13	3.90	4.69	3.14
Carrot	1.82	4.20	0.88	2.43
Cauliflower	6.32	0.40	0.40	2.44
Chilli	2.61	1.32	0.31	1.65
Cucumber	5.70	3.90	3.98	3.24
Okra	3.34	2.50	2.30	2.67
Pea	0.72	2.10	0.71	1.30
Potato	12.21	15.13	7.56	10.24
Radish	0.61	0.00	0.00	0.39
Sponge gourd	3.21	3.59	0.35	2.12
Tomato	3.64	2.63	4.77	4.76
Spinach	1.61	0.47	1.02	0.90
Misc. vegetables	6.60	0.57	0.48	3.96

Source: Derived from the survey conducted in the study area

rice to wheat in their food basket. Though cultivation of rice is more labour intensive than that of wheat, it requires less labour and energy for cooking. This indicated that the smallholders tended to optimize their overall labour and energy input in production and consumption processes.

Potato, tomato, cabbage, bottle gourd and cucumber were the main vegetables. Potato was the principal vegetable preferred by all. Smallholders, however, preferred vegetables, which were labour-intensive, short-duration and generated regular-income. For example, tomato, okra, chilli and spinach provided regular income to farmers, while radish, cauliflower and cucumber were the short-duration crops. All these vegetables were labour-intensive and required almost uniform labour throughout the production cycle, unlike cereals and pulses.

Among cash crops, sugarcane was an important crop from the view point of large farmers and was widely preferred by them (13 %) than smallholders (2.6%). It was both labour-intensive and remunerative crop but its long duration deterred smallholders to go in for its cultivation. Smallholders allocated relatively higher area to fodder crops than that by the large farmers. This can be attributed to the facts that firstly, the fodder has a good market in the region; and secondly, the smallholders practise more of livestock farming to augment their income and make constant use of the disguisedly unemployed family labour. These fodder crops required regular labour for cutting and chopping operations.

The above discussion suggests that smallholders dominate vegetable production. Resource endowments and utility maximization objectives of different category of farmers govern their crop choices. The smallholders usually opt for a production portfolio that gives quick, regular and higher returns and employs more labour. On the other hand, large farmers prefer those crops which employ less labour and have greater returns. Smallholders also cultivate a variety of vegetables to spread risk and intensify land-use.

(b) Economics of Production of Vegetables vs Cereals

Vegetable cultivation in the study area was picked up during the 1980s, due to improved road-connectivity and rising demand for vegetables. Higher profitability was the main driving force for shifting production portfolio in favour of vegetables. Economics of vegetable production has been compared with those of cereals and other crops (Table 3). It was noted that a majority of the vegetables were more profitable than cereals and other crops. The net profit over cost (A_2) of vegetables ranged from Rs 5591/ha for radish to Rs 12094/ha for eggpalnt. In contrast, the net profit over cost (A_2) of cereals ranged between Rs 2519/ha for maize and Rs 10384/ha for paddy. During the rainy season, eggplant and tomato had an edge over paddy and maize production. In the winter season crops, most of the vegetables were more profitable as compared to wheat.

Since vegetables have shorter duration than cereals, the net profit per day was also computed (Table 3). Smallholders preferred to cultivate short-duration crops to realize quick returns. The net profit over cost (A_2) on per day basis was considerably higher from vegetables than cereals. In the case of smallholders, the profit on per day basis was more relevant as it could be compared with the prevailing wage rates. The basic advantage of cultivating vegetables by the smallholders as revealed by analysis is that it yields early returns and is more remunerative than both cereals and pulses.

Table 3. Net revenue over cost A_2 of important crops

Crop	Net returns	
	Rs/ha	Rs/ha/day
Eggplant	12094	67
Carrot	11540	96
Paddy	10384	69
Tomato	10014	67
Cabbage	9366	104
Peas	9181	77
Spinach	8363	69
Chillies	8211	55
Potato	7765	86
Cauliflower	6996	58
Okra	6593	55
Radish	5591	62
Wheat	5495	37
Maize	2519	21

Source: Derived from the survey conducted in the study area

Table 4. Unit cost of production of important vegetables

(Rs/tonne)

Crop	Small farms		Large farms	
	Cost A_1	Cost C_2	Cost A_1	Cost C_2
Cabbage	420	1210	430	1580
Cauliflower	1050	3640	1600	9520
Cucumber	1150	3420	1610	6190
Eggplant	530	2160	550	3220
Okra	1200	3500	790	2770
Onion	400	1580	490	2570
Potato	770	1380	580	1650
Spinach	680	2680	220	1650
Tomato	670	2250	700	3900

Source: Derived from the survey conducted in the study area

Smallholders were found more efficient in cultivation of vegetables. Unit cost of production of different crops was computed for different categories of farms. The lesser the unit cost of production, the higher was the efficiency. It was observed that the smallholders had an edge over the large farmers in production of different crops (Table 4). The unit cost of production for most of the vegetables was lower on small farms than large farms. For instance, the unit cost of production of eggplant was 64 per cent

lower on small farms than large farms. Similarly, it was 58 per cent less for tomato, 54 per cent less for spinach and 31 per cent for potato on small farms than large farms.

These results corroborate the hypothesis that smallholders are more efficient in production of vegetables. The advantage that smallholders behold is the availability of larger family labour, which helps in a better management of vegetable production. It may be noted that vegetable production requires regular management, unlike cereals, pulses and other cash crops. The share of owned-inputs such as family labour, bullock power and organic manure in the total cost was higher on smallholders than large farmers. However, such a scenario continued until the opportunity cost of family labour was low where off-farm employment opportunities were meagre. Increased migration of rural workforce to the urban areas would substitute the family labour by hired machines and affect the existing comparative advantage of smallholders. Therefore, efforts should be made to direct future R&D work towards designing tools and machines that suit the needs of smallholders.

(b) Employment in Production of Vegetables and Cereals

The biggest advantage for smallholders is the availability of their family labour. Smallholders owned about 4.5 persons/ha as compared to 1.2 persons/ha on medium farms and 0.5 persons/ha on the large farms. The smallholders thus had comparative advantage in switching-over to more remunerative and labour-intensive crops. Generating productive employment for smallholders through agricultural diversification would not only raise their income but also improve their food and nutritional security. In this section, we have tested the hypothesis that diversification towards vegetables provides more employment opportunities than those by the foodgrain crops.

Diversification to vegetables provides ample scope to smallholders for taking advantage of higher availability of labour. Table 5 provides information on average labour-use in different commodity groups in the study area. It was observed that cultivation of vegetables required 58 per cent more labour than that by cereals. On an average, vegetable production required approximately 64 mandays/ha in comparison to 41 mandays for cereals.

Crop-wise labour use, given in Table 6, clearly shows that by and large vegetable production requires more labour than cereals. This factor played a crucial role in deciding the production-portfolio. Besides profitability and market access, the crop preference was largely influenced by the labour supply and the prevailing wage rates. While the smallholders opted for labour-intensive crops, the large farmers preferred labour-saving crops. The present discussion makes it abundantly clear that the cropping pattern followed by

Table 5. Labour-use in different crop groups on the sample farms

Crop group	Labour use (mandays/ha)		
	Male	Female	Total
Cereals	21.17	19.33	40.50
Pulses	11.33	12.58	23.92
Vegetables	31.01	33.09	64.10
Sugarcane	26.67	37.00	63.67

Source: Derived from the survey conducted in the study area

Table 6. Labour used in different crops on the sample farms

(mandays/ha)

Crop	Male	Female	Total
Paddy	35	33	69
Wheat	24	16	41
Maize	17	16	33
Chickpea	12	15	27
Pigeonpea	11	11	21
Sorghum	8	12	20
Sugarcane	31	39	70
Vegetables			
Bottle gourd	25	36	62
Carrot	30	35	65
Cauliflower	23	32	55
Chilli	34	36	70
Coriander	22	22	44
Onion	27	57	84
Pea	22	33	55
Round gourd	41	50	91
Spinach	20	35	55
Tomato	37	50	87
Turnip	16	28	44
Watermelon	33	44	77

Source: Derived from the survey conducted in the study area

smallholders in the study area had the predominant presence of vegetables unlike large farmers who preferred cultivating cereals.

Interestingly, diversification towards vegetables provided more employment opportunities to women. With some exceptions, the sample farmers in the study area employed more women labour for vegetable production (Table 6). These findings do not match with the earlier conclusions drawn by von Braun (1995) that women work less on more commercialized crops than men or hired labourers. This conclusion was drawn by the authors

based largely on observations on labour-use in sugarcane, spices, dairy and maize farms in developing countries in Africa and Asia. Our observations showed that women labour was often used for those vegetable production activities, that required regular management, such as thinning, weeding, picking, harvesting, cleaning and grading. In most of the small farms in India, women are largely engaged in the production activities while men undertake marketing. Diversification to more commercialized commodities on large farms would definitely involve use of more men and hired labourers.

The above discussion clearly demonstrates that diversification towards vegetables would generate considerable income and employment opportunities for the farmers, particularly the smallholders. Earlier, von Braun (1995) had concluded that commercialization of agriculture benefits the poor by directly generating employment and augmenting their income. The impact of diversification and commercialization would have direct bearing on poverty alleviation and nutritional security of the poor households in the developing countries. Agricultural diversification could be a highly effective development strategy to directly attack poverty in the labour-surplus regions. However, it would require appropriate markets and institutions, efficient information and technology dissemination system and risk management measures to be put in place. In the absence of an integrated approach, agricultural diversification towards high-value and perishable commodities may adversely affect the smallholders, as these are highly susceptible to both production and marketing risks. In the following section, we shall discuss some of the constraints associated with agricultural diversification towards vegetables.

Constraints to Smallholders in Diversification

It has been clearly shown that smallholders are efficient in production and opt for a production portfolio that is more remunerative and labour-intensive. However, there are inherent problems in the developing countries, which come in the way of diversifying agriculture. In this section, the key problems associated with agricultural diversification, particularly vegetable production have been highlighted.

The principal constraints faced by the smallholders in vegetable production are the non-availability of good quality seeds, absence of appropriate markets, high volatility in prices and lack of access to technical know-how.

(a) Non-availability of Good Quality Seeds

Smallholders are often regarded as laggards in adoption of improved technologies, including seeds, which is mainly due to either lack of information or paucity of resources. In the study area, the percentage of smallholders

opting for improved variety of seeds was 44 per cent as compared to 55 per cent in case of large farmers.

Even at the national level, it has been estimated that the number of farmers adopting improved varieties of vegetables is higher for large farmers than smallholders (NSSO, 1999). There is a clear-cut trend that the area under improved varieties increases with increase in size of landholdings (Table 7). However, large farmers use more of the certified (improved) seed than that by small farmers, who use improved seed, which may not necessarily be certified. Large farmers had allocated approximately 77 per cent of the total vegetable area under certified seeds as compared to about 53 per cent by smallholders. Often, home-produced seeds of improved varieties are preferred by the smallholders.

A majority of the sample farmers (81%) reported that the problem in vegetable production was related to either non-availability of good quality seeds or their exorbitant prices. It was observed that farmers did not trust the quality of seeds supplied by village seed dealer even though seeds might be branded or claimed to be of improved variety. There were apprehensions that duplicate seeds of branded companies were sold by the village seed dealers. Another reason cited by the farmers was exorbitant price of the improved seeds. Even if one invested in the expensive and improved varieties, their performance was not assured. This was due to weak and under-developed seed market in the vegetable sector. The absence of key seed players in this sector is due to uneconomic scale of operation. This problem has been addressed and well managed in the niche areas by strengthening supply chain through cooperatives or contract farming. *Safal*, a subsidiary of the National Dairy Development Board, integrates fruits and vegetables production through a retail chain in major metropolitan cities, viz. Delhi, Bangalore and Mumbai. It sources fresh fruits and vegetables from producers' associations and facilitates procurement of quality inputs (including seeds) and provides technical know-how to them (Birthal *et al.*, 2005). Such arrangements ensure availability of quality and reliable seeds and other inputs at reasonable prices.

Table 7. Distribution of area under improved seeds by farm size

(in per cent)

Quality of seeds	Small	Medium	Large
Certified	48	56	70
Uncertified	20	18	8
Home grown	25	22	22
Other sources	7	4	0

Source: Government of India (1999)

(b) Low Volume of Marketable Surplus

Another important problem faced by the smallholders in vegetable production is related to output markets. The problems are related to poor access to markets, absence of reliable marketing agencies and high post-harvest losses. These problems are largely linked with low volume of marketable surplus, which constrains smallholders from bargaining effectively. On an average, it was noted that the marketable surplus of smallholders was 38 per cent less than that of the large farmers. The marketable surplus of the smallholders was as low as 6 kg for eggplant, 8 kg for chilllies and 10 kg for okra (Table 8). Such a small-sized marketable surplus considerably increases the transaction cost and reduces bargaining power of smallholders (Birthal *et al.,* 2005). Though the smallholders are cost-effective in vegetable production, the higher transaction cost negates their comparative advantage. The overall profitability (including production and marketing) of smallholders in comparison to large farmers is adversely affected by the high transaction costs (Birthal *et al.,* 2005). High transportation cost of small-sized marketable surplus raises the transaction cost. The share of transportation in total marketing cost was found approximately 40 per cent, which could be brought down significantly by organizing farmers through cooperatives and contract farming.

(c) Higher Price Risk

Farmers are faced with higher production and price risks in production of vegetables than cereals. Smallholders are more susceptible to such risks. The coefficients of variation in the yield of vegetables and cereals were computed to compare the magnitude of risk. The coefficient of variation in yield was much higher for vegetables than cereals. Production of vegetables is a more risky proposition than of cereals due to host of biotic and abiotic constraints. Varietal improvement and efficient management practices are yet to be evolved for vegetables, like the ones for cereals. Even though the

Table 8. Average marketed surplus of important vegetables

(in kg)

Vegetables	Small	Large
Carrot	8	25
Eggplant	6	32
Okra	10	52
Cucumber	40	89
Tomato	32	169
Potato	345	630

Source: Derived from the survey conducted in the study area

resistant varieties and good management practices exist, these are yet to be adopted by the farmers due to lack of information and resources. The smallholders are affected largely on account of high yield-risks. The coefficient of variation of vegetables on small farms was 63 per cent as compared to 56 per cent on large farms.

High risk in vegetable production, particularly on small farms, has been limiting the expansion of vegetable production. Crop failure due to diseases or insect infestation or change in weather adversely affects vegetable production, thus threatening food security of smallholders. Farmers' experience revealed that pest or disease incidence in vegetables could even completely ruin the crop. Resistant varieties and improved management practices are available in case of vegetables, but their adoption is still in infancy . Efforts aimed at popularizing improved varieties and technologies are indeed desirable, particularly from smallholders' viewpoint.

High price volatility was another major constraint in vegetable production. Approximately 65 per cent of the farmers indicated that low or fluctuating prices adversely affected their profitability. Vegetable prices were too sensitive to the supply. It was experienced that increase in supply of vegetables beyond a threshhold caused a steep decline in their prices. Information from the Delhi Vegetable Market, India (one of the largest vegetable markets in Asia), showed a very high coefficient of variation (66%) in the vegetable prices. Declining prices adversely affect the profitability of vegetables of smallholders. Steep fall in prices would definitely have a serious impact on their income and food security.

At present, no institutional arrangement exists to protect vegetable farmers from risk. Farmers diversify their production portfolio to overcome their problems. It was noted that the diversity index of smallholders was 93 per cent as compared to 76 per cent on large farms. Such a high diversity for smallholders is to minimize risk arising due to production and output prices. Price stability in vegetables can be ensured through better market integration. It is possible through (i) better information network on prices in different markets, and (ii) better road and rail network. Some private sector initiatives, especially of *E-Choupal* (of Indian Tobacco Company), Rural Information Kiosks (of EID Parry) and *I-Kisan* Portal (of Nagarjuan Group) are often cited, which provide information on cultivation practices, prices, weather, etc. Such initiatives are yet to be spread to the remote areas for vegetable production.

Opportunities for Vegetable Production

The foregoing discussion has clearly shown that vegetable production is more profitable for smallholders, but there are problems of high transaction

costs and production and market risks. The existing constraints need to be converted into opportunities. It is possible if an effective linkage is developed between production and markets. Such a linkage is possible where the vegetable producers get easy access to markets, especially in the urban and peri-urban areas. In other areas, farmers are deprived of the potential benefits of diversification towards vegetable production. In some instances, they lose due to lack of market access and steep fall in vegetable prices. The production and marketing linkages can be strengthened through institutional arrangements such as cooperatives and contract farming.

As stated earlier, *Safal*, a subsidiary of National Dairy Development Board, is effectively integrating production and marketing in fruits and vegetables. The firm contracts with the Producers' Associations for procuring fruits and vegetables for selling through its retail chains in Delhi. The firm gives a crop plan to each association, provides technical know-how and facilitates procurement of inputs, including seeds, at wholesale prices. The produce from all members is procured in the village, and after verifying quality, it is transported to firm's main collection centre for further quality control and distribution to the retail chain in Delhi. The firm provides assured market to the producers and pays a premium above the prevalent modal price in Delhi market. Farmers save while procuring inputs and transporting produce besides getting higher prices. Presently, the firm operates with 150 associations, each having 20-25 members. The firm procures and sells about 200 tonnes of fruits and vegetables every day.

The participating farmers gain substantially in reducing the production and transaction costs as a result of contracting with *Safal*. The smallholders gain more from participation in contract farming. The net profit of smallholders, who contracted with *Safal*, was 97 per cent higher for spinach than that of non-contracting smallholders (Table 9). For large farmers, the corresponding profit was 50 per cent higher. The higher net profit of contract farmers was due to (i) lower unit cost of production, (ii) lower transaction cost, and (iii) higher output prices due to better quality. Main advantage of contract farming in vegetables was substantial reduction in transaction cost through economies of scale in acquiring inputs, access to new technology and output transportation.

The discussion clearly demonstrates that the institutional arrangement of linking production with markets benefits more to smallholders. The firm has a strong mechanism for backward and forward integration to reduce production cost, minimize transaction cost and improve product quality. Such institutional arrangements overcome market hurdles faced by the smallholders in perishable commodities. Existence of such strong supply chains facilitates smallholders to diverse towards vegetables and encourages investment on

Table 9. Cost and profit in spinach production under contract and non-contract farming modes

(Rs/tonne)

Item	Contract producers			Non-contract producers		
	Small	Medium	Large	Small	Medium	Large
Production cost	1448	1478	1485	1620	1638	1685
Transaction cost	34	8	46	507	347	273
Total cost	1522	1486	1531	2127	1985	1958
Net profit	1818	1809	1762	920	1122	1169

Source: Birthal *et al.* (2005)

specialized assets to further cut in the production cost and improve production efficiency. Since the firm is strictly enforcing quality aspects, the price premium is relatively higher. Therefore, there is a need to upscale such institutions to promote agricultural diversification in areas where smallholders are concentrated.

Conclusions

The study has examined the impact of vegetable production on smallholders and has identified the factors limiting its expansion. The results clearly reveal that vegetable production is more profitable and labour-intensive, therefore it suits the smallholders. The smallholders are relatively more efficient in production and own more family labour than that by farmers. The unique characteristic of smallholders is that they choose a production-portfolio that has high, quick and regular returns and utilizes the available family labour resources. Vegetable production meets these criteria and therefore is more popular among smallholders. Vegetable production is the emerging sector in agriculture that would augment income of smallholders and generate employment opportunities in the rural areas. Women are also benefited as the vegetable production engages a relatively higher women labour in various operations. It can be concluded that vegetable production is pro-poor and offers immense opportunities for smallholders and women farmers.

However, prevailing constraints do not allow smallholders to fully expropriate the emerging opportunities in vegetable production. Major constraints in vegetable production are lack of an assured market and a well-developed seed sector. Since vegetables are perishable in nature, lack of efficient marketing system and appropriate infrastructure result in huge post-harvest losses. Further, non-availability of improved and good quality seed reduces the profitability and increases production risk. Other important

factors that restrict expansion of area under vegetables are higher risks in price and yield as compared to those in cereals and low marketable surplus that increases transaction costs. The vegetable prices are highly volatile, which severely affect the profitability in the event of marginal increase in supply. Low volume of marketable surplus also adversely affects the bargaining power of smallholders and thus results in realizing lower prices. The possible solution for overcoming this is through developing institutional arrangements that strengthen farm-firm linkages. Contract farming is one such arrangement that helps smallholders to overcome the constraints in vegetable production.

Appropriate institutional arrangements would promote vegetable production and ensure a reliable and remunerative market for smallholders to harness the opportunities emerging out of the on-going process of globalization and urbanization. It is therefore important that appropriate institutional arrangements should be put in place, particularly in areas where poor and smallholders are concentrated and depend on agriculture for their livelihood.

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