Journal of Community Mobilization and Sustainable Development Vol. 14(3), 553-559, September-December, 2019

Profitability Vs Sustainability as the Small Holder Farmers' Dilemma in Central Uttar Pradesh

S.K. Dubey, A.K. Singh[1], Lakhan Singh[2], Atar Singh, V.K. Kanaujia[3] and Bhupendra Kumar Singh[3]
ICAR-Agricultural Technology Application Research Institute, (ATARI), Kanpur
[1]Division of Agricultural Extension, Indian Council of Agricultural Research, KAB-1, New Delhi
[2]ICAR-ATARI, Pune, Maharashtra; [3]KVK, Kannauj

ABSTRACT

Survey was conducted (2014-16) in villages Digsara, Basirpur mar, Pokhra and Bhavanipur under Jalalabad block of Kannauj districts and; Kandharapur, Musa Khediya, Usmanganj, Daheliya, Badheli and Kanhau Yakutpur from selected two blocks of Farrukhabad districts to analyze the crop diversification systems, their profitability, perceived sustainability and the related issues. In every village, four focused group discussions (FGD) were arranged, each comprised of 30-35 farmers. Thus, 2500 farmers from all the 12 villages were interacted. Major research variables included the documentation of crop inventory along with their productivity (q/ha), gross cost of production (Rs/ha), gross return (Rs/ha), B:C ratio and employment created (mandays/year). Findings of the study showed that there were 10 different cropping systems which were cereal based, potato based, vegetable based or maize based. Even the indigenous system of mixed cropping based systems of jasmine and pumpkin with potato were also popular. The profitability, employment generation and perceived sustainability of these systems were comparatively analyzed. The perceived strength and weaknesses, and opportunity as well threat of the existing diversified systems were ascertained from the farmers' view points. Lastly, the temporal trends of various economic indicators of summer maize was depicted which was getting more popular among the farmers even it was cost intensive as compared to other options of summer crops.

Keywords: Crop diversification, Vegetable based systems, Cereal based system, Profitability and sustainability

INTRODUCTION

Small-holder farmers are vital for India's agriculture and rural economy. Small-holder farmers - defined as those marginal and sub-marginal farm households that own or/and cultivate less than 2.0 hectare of land - constitute about 78 per cent of the country's farmers (at Agricultural Census 1990-91). These small-holders owned only 33 per cent of the total cultivated land; their contribution to national grain production however, is 41 per cent. Their contribution to household food security and poverty alleviation is thus disproportionately high - and is increasing (FAO, 2014, Mulwa *et al*., 2017). Moreover, as the national population increases, so does the number of small-holdings.

Small-holder families constitute more than half of the national population. It is thus disappointing that notwithstanding their substantial and increasing contribution to the national food supply and to agricultural GDP, these small-holder families nonetheless constitute more than half of the nation's totals of hungry and poor (Joshi *et al*., 2006). Policies and programmes to lessen poverty and food insecurity, and to enhance equity and sustainability of incomes and livelihoods, should thus seek to achieve an agriculture-led broad-based economic development - and to do so by according highest priority to small-scale agriculture.

The questions are here posed: is the continuance of Indian hunger and poverty a consequence of the smallness of the preponderant majority of the nation's farms?... or may the productivity of those small farms be so increased as to allow the small-holder families - and the nation with them - to escape from hunger and poverty? We shall reason in support of the second (hopeful) option. But the hope will be realized only when the small-holders are empowered to access the crucial production resources. These resources are several: land, water, energy, and credit; appropriate technologies, and opportunities to develop

*Corresponding author email id: skumar710@gmail.com

the skills and to access the information wherewith to use them; functional and fair markets for products and inputs; health care and sanitation; and education and reproductive and social services. Given the national and international policies that facilitate access to such resources, there would be confident expectation that small-scale agriculture could and would achieve higher production and income and that the livelihoods of small-holder families and communities would be enhanced.

Between 1971 and 1991, India's total number of farm holdings (aggregate for all farm sizes) increased from 70.5 million to 106.6 million. Within those totals, the small-size holdings - encompassing the categories *sub-marginal* (less than 0.50 ha), *marginal* (0.50 to 0.99 ha), and small (1.00 to 1.99 ha) - increased from 49.1 million (70 per cent of the 70.5 million total) to 83.4 million (78 per cent of the increased total of 106.6 million). Correspondingly, the average size of holding (all sizes) decreased from 2.28 ha (1971) to 1.55 ha (1991) as the number of holdings and of farm families increased - the total agricultural-land area remained almost unchanged. Significantly, the average size of those holdings smaller than 2.00 ha did not decline; but the average size of holdings larger than 4.00 ha decreased from 9.18 ha in 1971 to 7.95 ha in 1991 - thereby lessening the national-average farm size. In 1991, small-size holdings, constituting 78 per cent of all holdings, commanded 33 per cent of the total net cropped area, while medium- and large-size holdings, constituting 22 per cent of the farmers, commanded 67 per cent. About three-fifths of all holdings were marginal or sub-marginal, and about one-fifth were small. However, sub-marginal holdings - comprising 40 percent of all holdings, commanded only 9.8 per cent of the total agricultural-land area. Contrastingly, large-size holdings (> 4.00 ha) accounted for only 9 percent of all holdings but commanded 44 per cent of the area. Between 1971 and 1991, the proportion of holdings smaller than 1.00 ha increased from 51 to 62 per cent. Under the given scenario, the farm income generated by those small holders becomes an area of interest and also it emanates the issues for investigation mainly in terms of that to what extent farmers have diversified their crop production system?, what are various crops and their combinations are prevailing alongwith their yield?, what is their relative contribution in income and employment generations?, how small holders perceive which system to be more sustainable over others and how they feel the different roles of various stakeholders in making their crop diversification system more operational friendly? Against the above background, therefore, study was conducted in the state of Uttar Pradesh to arrive at the empirical evidences to above research questions.

MATERIALS AND METHODS

The present study was conducted in the purposively selected Kannauj and Farrukhabad district of Uttar Pradesh. Two main reasons of large scale prevalence of small holders (about 75%) and mostly diversified cropping systems justified the purposive selection of the district. Further, two blocks namely Jalalabad and Kannauj from Kannauj district; and blocks Kamalganj and Mohmadabad from Farrukhabad districts were selected purposively because of meeting the above criteria. Six villages namely Digsara, Basirpur mar, Pokhra, Mitrasenpur, Baharin and Bhavanipur were randomly selected from these two blocks in Kannuaj districts. Similarly, Kandharapur, Musa Khediya, Usmanganj, Daheliya, Badheli and Kanhau Yakutpur from selected two blocks of Farrukhabad districts were randomly selected. In every village, four focused group discussions (FGD) were arranged, each comprised of 30-35 farmers. Thus, 2500 farmers from all the 12 villages were interacted during 2014-16. Major research variables included the documentation of crop inventory alongwith their productivity (q/ha), gross cost of production (Rs/ha), Net return (Rs/ha), B:C ratio and employment created (mandays/year). Accordingly, different types of cropping systems were classified as per the crop base. Further, the relative spread of summer maize and summer groundnut were analyzed over time and space to see their relative preferences among the small holders in these two crops. For each type of cropping system, crop equivalent yield (Ahlawat and Sharma, 1993) for the major crops in the given system was worked out using following formula:

$$\text{Crop Equivalent Yield (CEY)} = \sum_{i=1}^{n} Y_{xi}(P_{xi}/P_r)$$

where, Y_{xi} is the yield of i^{th} alternate crop crop(s) (kg ha^{-1}),

P_{xi} is the price of i^{th} alternate crop(s) (Rs. kg^{-1}), and

P_r is the price of main crop taken for equivalent yield (Rs. kg^{-1}).

The variables like profitability and employability in those systems were computed in terms of net return (Rs/ha/year) and mandays created (nos./year) respectively. The relative sustainability of the systems were ascertained on five points sustainability rating scores wherein 1 being the least sustainable and 5 being the most sustainable systems

as perceived by the small holders. Further, SWOT analysis and famers' perception were captured using open-ended questions and based on the response, results were arranged rank-wise. A semi-structured interview schedule supported with group discussion was utilized to elicit the information from the respondents. The collected data were analyzed (2016) using the simple statistics of average, percentage, rank, rank correlation (r) and coefficient of concordance (w) to draw meaningful conclusions.

RESULTS AND DISCUSSION

Prevailing cropping systems

Traditional system: Paddy-wheat is the major traditional cropping systems in both the districts followed by green manuring-early potato-wheat. However, paddy-wheat system emerged to be more profitable over another as indicated by higher B:C ratio of 3.0 (Table 1).

Maize based system: Four types of maize based cropping systems were observed prevailing in the districts (Table 2). The most profitable system was Green manuring-potato-maize in terms of B:C ratio (3.0). However, in terms of absolute return, green manuring-early potato-potato-maize was the most profitable (Rs 438.76 th./ha as gross return) followed by *kharif* onion-potato- maize (Rs 426.40 th./ha) and maize-potato-maize (Rs 347.64 th./ha). It is evident from the table that summer maize in all the three systems performed uniformly.

Vegetable based system: Three important vegetables namely onion, coriander and summer potatoes were integrated in the cropping system by the small holders. As indicated in the Table 3, though the B:C ratio for both the systems were same (2.7), the gross return was higher for coriander (Rs 640.13 th./ha) based system as summer onion was another vegetable in this system as compared to the system in which only one vegetable was integrated.

Summer groundnut based system: Summer groundnut has been also a good option for zaid season. This crop though requires lesser number of irrigation as compared to summer maize, its popularity has been declining owing to lesser profit earned from this crop as compared to the summer maize. Two major systems were prevalent in the area. Firstly, summer ground nut was preceded by *rabi* potato and *kharif* groundnut and secondly with *rabi* potato and *kharif* maize. However, the gross return was more in

Table 1: Traditional cropping system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Paddy-Wheat	61.33	48.29	-	66.85	201.49	3.0
GM-Early Potato-Wheat	-	192.10	46.06	114.06	243.50	2.1

Table 2: Maize based cropping systems

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Maize-Potato-Maize	32.42	278.08	60.30	130.70	347.64	2.7
GM-Early Potato-Potato-Maize	-	256.00	64.17	182.15	438.76	2.4
GM-Potato-Maize	-	320.37	67.66	112.90	335.99	3.0
Kharif onion-potato-maize	176.45	252.70	65.66	194.40	426.40	2.2

Table 3: Vegetable based system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Coriander-potato-onion	40.60	296.43	236.29	236.50	640.13	2.7
Maize-Early potato- Summer tomato	33.80	200.53	476.22	188.15	505.71	2.7

case of first cropping sequence than second as evident from Table 4.

Mixed cropping based system: Two indigenous potato based mixed cropping were documented in the study area. In one case, potato was mixed cropped with jasmine flower and in another case; pumpkin was taken as the mixed crop with potato. Data (Table 5) showed that potato mixed with jasmine was more profitable (B: ratio of 2.6) as compared with potato+pumpkin (B:C ratio of 2.5).

Crops equivalent yield: For different kinds of cropping systems. Equivalent yields for the major crops were computed and presented in the Table 6.

Therefore, potato, wheat, groundnut, maize, vegetable and jasmine equivalent yields were computed. It is observed from the table that in all the cropping systems, potato and vegetable equivalent yield was prominent. This was followed by maize equivalent yield. Whereas potato equivalent yield was highest for maize-potato-maize (556.00) sequence, vegetable equivalent yield was highest for coriander-potato-onion (550.75) sequence. Actually, spring onion fetched better price and also the coriander leaves in *kharif* had greater demand which added to the farmers' income. This was followed by the cropping sequence in which *kharif* maize was followed by early potato and then summer tomato (454.42) and *kharif* onion-potato-maize (353.3). With the advent of hybrids in maize and with ensured availability of quality inputs and procurement by the private organizations, maize based cropping system was getting more popular and profitable

Table 4: Summer groundnut based system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Kharif G/nut-potato-Summer G/nut	16.72	310.45	32.19	157.00	412.96	2.6
Maize-Potato-Groundnut	35.63	288.76	29.84	146.30	380.30	2.6

Table 5: Mixed cropping system

Cropping system	Yield of crops (q/ha)			Cost of Production (th. Rs./ha)	Gross Return (th. Rs./ha)	B:C ratio
	Kharif	*Rabi*	*Zaid*			
Potato + Jasmine	0	80.55	208.36	272.15	709.35	2.6
Potato+Pumpkin	00	300.0+ 220.0	-	112.50	280.25	2.5

Table 6: Equivalent yields of the major crops in the existing systems

Cropping system	Wheat Equiv. Yield (WEY)	Potato Equiv. Yield (PEY)	Groundnut Equiv. Yield (GEY)	Maize Equiv. Yield (MEY)	Vegetable Equiv. Yield (VEY)	Jasmin Equiv. Yield (JEY)
Paddy-Wheat	54.00	-	-	-	-	-
GM-Early Potato-Wheat	153.68	-	-	-	-	-
Maize-Potato-Maize	-	556.00	-	64.82	-	-
GM-Early Potato-Potato-Maize	-	256.00	-	512.00	-	-
GM-Potato-Maize	-	170.00	-	104.00		-
Kharif onion-potato-maize	-	110.00	-	285.43	353.3	-
Coriander-potato-onion	-	393.00	-	-	550.75	-
Maize-Early potato- Summer tomato	-	169.00	-	-	454.42	-
Kharif G/nut-potato-Summer G/nut	-	-	47.77	-	-	-
Maize-Potato-Groundnut	-	-	53.19	-	-	-
Potato + Jasmin	-	-	-	-	-	16.11

as evident from the Table 6. The lowest equivalent yield was estimated for jasmine in the mixed cropping system of potato+jasmine (16.11) followed by for groundnut in the *kharif* groundnut-potato-summer groundnut (47.77) cropping sequence.

Profitability, employability and perceived sustainability of various systems

Altogether, a complex scenario emerged in the prevailing varied cropping systems, their profitability, employment generation and farmers' perception of the sustainability of these systems. As indicated in the Table 4, flower based potato intercrop raised the highest profitability (Rs 4.37 lakh/year/ha) which was closely followed by high density vegetable based diversified system (Rs 4.04 lakh/year/ha). The employments generated by both the system were in similar order (447 and 433 mandays/year/ha) indicating thereby the ensured employment for more than family member round the year. It is also evident from the same table that the reality of less profitability from the cereal based system is being recognized by the small holders e.g. in case of paddy-wheat-green manuring, green manuring-early potato-wheat and maize-mustard-maize the profitability ranged from Rs 1.29 – 1.93 lakh/year/ha with relatively lesser mandays generated. In most of the system, where potato was the main element and groundnut was taken either as *kharif* or summer crop, the profitability was more. Farmers were also asked to accord their preference rating of the sustainability of each system in terms of likely resource exhaustion and future continuance as perceived by them. It is evident from the same table that all the input intensive systems were computed more profitable compared to others but their sustainability (on the basis of underground water exhaustion) ratings were lower. Summer maize based cropping system emerged as less perceived sustainable system whereas summer groundnut based system was felt comparatively more sustainable. Interestingly, however, the input intensive vegetable based cropping system was also rated high from sustainability points of view which may be because of the fact that small holders farmers practicing such system may be maintaining the soil fertility through appropriate measures which was also affordable for them to do so.

As indicated in the first subhead that summer maize is having stiff competition with summer groundnut on irrigation requirements, but it has considerable profitability and ease of operations including now the use of mechanization in summer maize (even combine harvester is being used) which is strongly sustaining it in the system. Albeit, there was clear cut mismatch between the perceived profitability and perceived sustainability of the system as indicated by the non-significant rank correlation value (0.355). However, in the evolution of the cropping systems as discussed above, farmers' more preference to substitute the input intensive crops by the less input demanding crops

Table 7: Crop diversification inventory and their profitability and sustainability

Cropping pattern	Profitability (lac Rs/ year/ha)	Employment (Mandays/year/ha)	Sustainability rating (out of 5)
Paddy-Wheat	134.64	205	4.10 (I)
GM-Early Potato-Wheat	129.44	213	3.40 (III)
Maize-Potato-Maize	216.94	310	4.00 (I)
GM-Early Potato-Potato-Maize	256.61	272	3.27 (IV)
GM-Potato-Maize	223.00	244	3.10 (VII)
Kharif onion-potato-maize	232.00	360	3.00 (VIII)
Coriander-potato-onion	403.63	433	3.21 (V)
Maize-Early potato- Summer tomato	317.53	451	3.11 (VI)
Kharif G/nut-potato-Summer G/nut	255.96	451	2.90 (IX)
Maize-Potato-Groundnut	234.03	383	3.45 (II)
Potato + Jasmin	437.20	447	3.10 (VII)
Rank correlation coefficient (r)	**0.67***	-	
Coefficient of concordance (w)	**0.355^{NS}**		

** p<0.01 ; NS: Non-significant; Letters in parentheses indicate the ranking*

particularly in the potato based cropping system was disclosed through this investigation.

SWOT analysis of crop diversification

The perceived strength, weaknesses, opportunities and threats of the diversification of the cropping system in the study area was analyzed and presented as in Table 8. The results indicate that providing climatic resilience and enhancing the farm income were major strength of crop diversification. However, it was also felt by the respondents that real potential of crop diversification was not tapped by them as they lacked in the know-how and do-how of the nutrient managements and the related packages of practices. This is the area which demands attention by the related KVKs or associated line departments. However, as vegetables were the key elements of the their diversified cropping systems, farmers opined that for the small holder farmers, one acre viable and sustainable model of crop diversity may be validated for its upscaling as the potential opportunity.

Similarly, as the inclusion of more crops in the system involves more economic activities, the diversified system has the potential to ensure regular and meaningful employment to the farm family, thereby checking the rural migration. Similarly, processing and value addition was also seen as the future opportunity. Paradoxically, however, most of the farmers felt that inadequate market support, high perishability of the produces and the higher storage cost are some of the potential threats which may adversely affect the crop diversification among the small holders in the area. The non-significant coefficient of concordance (w) revealed that farmers' understanding of strength, weaknesses, opportunities and threat for the diversified cropping system were not of the similar degree. Gajbhiye *et al.* (2014) and Rohit *et al.* (2017) also reported the roles of delivery system and the related stakeholders in agriculture.

Table 8: SWOT Analysis of Diversification

Perceived strength	**Rank**
Ensured production	II
Enhanced income	I
Regular farm employment	III
Provide climate resilience	I
Perceived opportunity	
Processing and value addition	III
One acre viable and sustainable model	I
May check seasonal migration	II
Perceived weakness	
Improper nutrient management	I
Poor know-how of the packages	II
Perceived Threats	
Inadequate marketing	I
High storage cost	II
Perishability of the produce	II

Coefficient of concordance (w) = 0.477^{NS}

Area expansion, production and economic trends of summer maize

Analysis done above showed that small holders have experimented a lot to evolve the most profitable and engaging cropping systems over the period of time in the selected districts of Uttar Pradesh. Two Important concluding observations were made. Firstly, the summer maize is becoming very popular as against the other low input intensive options like summer groundnut and moongbean. Secondly, the vegetable based cropping systems are becoming more remunerative and income generating on everyday basis which is also the priority of the small holders. However, both the crops of summer maize and vegetables are though input intensive but sustaining and getting popular in the system only because of the fact that it is the profitability and employability derived from these crops which is determining their continuance in the system as compared to the other less input intensive and comparatively less profitable crops as summer groundnut and green gram. Consequently, the trends of summer maize as shown in Fig 1 clearly show that even at the constant level of productivity, area under summer maize has increased multifold during last ten years. Also, the gross and net return from summer maize has shown the increasing trends over the period of time in these districts mainly because of the reason of ensured availability of inputs by the private partners and assured procurement of the produce by them at the reasonable price.

Findings of the study helped to establish that there has been a reasonably increasing trend in the crop diversification among the small holders in the state of Uttar Pradesh. Varieties of crops have emerged and taken space in the cropping system. Also, there has been shift from cereal crops to more integration of cash crops, vegetables and other commercial crops like flowers in their existing

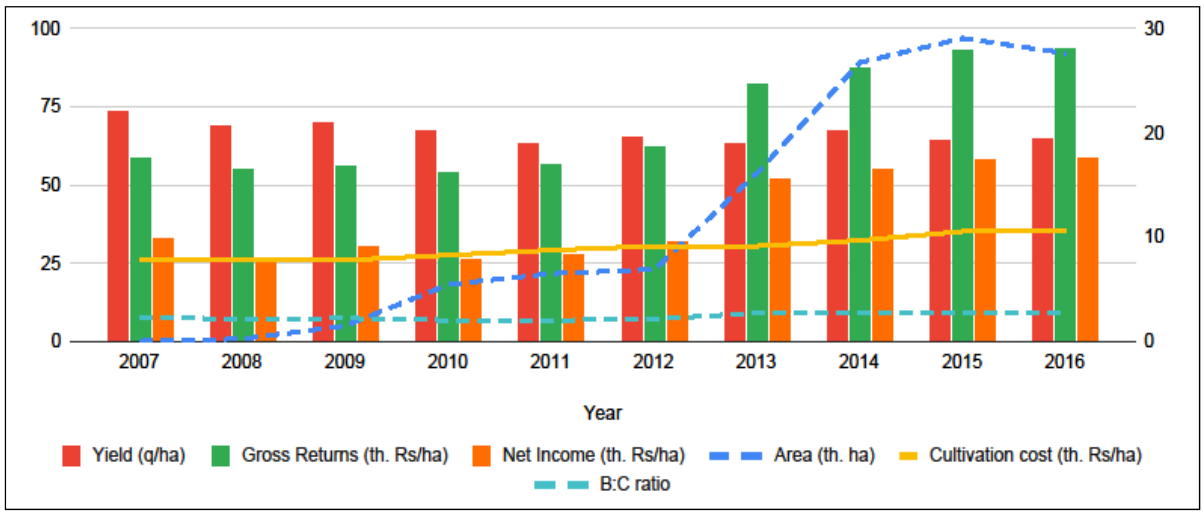

Figure 1: Area expansion of summer maize and related economics

system. The profitability of the cropping system was found to be the greater determinants than the sustainability strength of other crops if the assured supply of input coupled with procurement of produce is timely ensured by any agency. At the same time, farmers expressed that the diversified cropping systems, especially vegetable and potato based, despite being more profitable and employment generating, suffer from the usual threats of inadequate marketing logistics and storage provisions. In the given complex scenario, small holders have extended their more credence on the input dealers and also emphasized the need for strengthening farmers' organizations.

REFERENCES

Ahlawat, I.P.S. and R.P. Sharma. 1993. *Agronomic Terminology*, Indian Society of Agronomy, New Delhi, India, 3rd edition, P: 198.

FAO. 2014. *The State of Food and Agriculture*. http://www.fao.org/home/en/.

Mulwa, C.; P. Marenya; D. Bahadur and M. Kassie. 2017. Climate Risk Management Response to climate risks among smallholder farmers in Malawi : A multivariate probit assessment of the role of information, household demographics, and farm characteristics. *Climate Risk Management, 16*, 208–221.

Joshi, P.K.; Laxmi Joshi and P.S. Birthal. 2006. Diversification and Its Impact on Smallholders: Evidence from a Study on Vegetable Production. *Agricultural Economics Research Review,* 19(2): 219-236.

Jagriti Rohit; Premlata Singh; S.K. Dubey; B.K. Singh and N.V. Kumbhare. 2018. An Analysis of Support System Facilitating Peri-Urban Vegetable Cultivation. *Journal of Community Mobilization and Sustainable Development,* 13(2): 347-353.

Rahul Gajbhiye; M.S. Nain; Premlata Singh; S. K. Dubey and J.P. Sharma. 2014. Comparative Assessment of Seed Delivery System in Patiala District of Punjab. *Journal of Community Mobilization and Sustainable Development*, 9(2): 129-133.

Received on July 2019, Revised on December 2019