

## Economics of diversification of existing farming systems in Pune district of Maharashtra

R. B. HILE, Y. C. SALE AND D. J. SANAP

Department of Agricultural Economics,  
Mahatma Phule Krishi Vidyapeeth, Rahuri  
Dist.Ahmednagar-413722, Maharashtra

Received: 29-11-2016, Revised: 20-12-2016, Accepted: 28-12-2016

### ABSTRACT

A field experiment was conducted on farmer's field at plain zone area of Pune district during the year of 2014-15. The study was carried out with before and after approach for study the economics of diversification of existing farming systems. Before diversification, the results of crop component, animal component, product diversification and capacity building were Rs.2,05,209, Rs. 33,502, Rs.7,607 and Rs 2,63,674. After diversification these were increased Rs.2,32,594 (13.34%), Rs.63,599 (89.84 %), Rs.1,311(72.38%) and Rs.33,185 (25.85%). These results were because of providing improved varieties and inputs, arranging visit and training to farmers on field crop production, providing technical knowledge of improved package of practices, supply for semen and artificial insemination and mineral mixture and goat kids of improved breed, providing technical knowledge regarding animal health and providing equipments like grading sieve /ghee making equipments, etc. The study results revealed that the interventions at each aspect of crop, animal and product diversification were increases in employment, income and improved the standard of living of selected farmers. The sustainable diversified farming systems are seen highly profitable and the appropriate diversification of components increases the production per unit area, and reduced the costs of production.

**Keywords:** Diversification, cropping pattern, farming systems, sustainability

Diversification is the outcome of the interactive effect of resource related factors viz; irrigation, rainfall, soil fertility, technology related factors viz; seed, fertilizers, marketing, storage, processing and household related factors viz; food and their price, etc. With the advent of modern technology, there is continuous surge for diversified agriculture in terms of crops, animals and product diversification with economic consideration. Crop diversification is needed to give a wider choice in the production of a variety of crops in a given area so as to expand production related activities on various crops and also to lesson risks. Crop diversification is generally viewed as a shift from traditional grown less remunerative crops to more remunerative crops. The crop diversification also takes place due to governmental policies and thrust on some crops over a period time. Market infrastructure development and certain other price related supports also induce diversification. High profitability and stability in production also induce diversification. The experiments have been conducted on farmer's field in six centers in Pune district. Pune district was selected purposively for the present study and study has been conducted during the year 2014-15 with the specific objectives as to estimate the profitability in crop, animal and product diversification of selected households, to improve the livelihood and nutritional security through diversification, to estimate the impact of capacity building through diversification and to study the constraints in diversification.

### MATERIALS AND METHODS

The data of 24 field experimental trials under On Farm Research Centre at Haveli and Maval tahsils of Pune district were collected by the cost accounting method with the help of designed schedule provided by the Directorate, ICAR-Indian Institute Farming System Research, Modipuram, Meerut, Uttar Pradesh.

**Table 1: Treatments (Modules) conducted for diversification in Kharif and Rabi season (2014-15)**

Treatments	Interventions on farmer's field
M <sub>0</sub> Bench marks	Comprehensive survey along with GPS location.
M <sub>1</sub> Crop diversification	Change the cropping pattern and provided improved varieties with chemical fertilizers.
M <sub>2</sub> Livestock diversification	Supplies of Phule Triveni semen for A.I, mineralmixture, goat kids and poultry chicksof improved breed.
M <sub>3</sub> Product diversification	Provided grading sieves / ghee making equipments.
M <sub>4</sub> Capacity	Arranged training and building provided Sugi magazine / Krishi dairy to selected farmers.

In each tahsils, three villages and from each village, four farmers were selected. Thus, total 24 farmers were selected for the study. The bench mark survey were carried out for the year of 2012-13, and the diversification experimental field trials were conducted in *Kharif* and *Rabi* season during the year 2014-15.

## RESULTS AND DISCUSSIONS

### Existing and diversified cropping pattern of sample farmers

The cropping pattern is dependent on several factors such as soil type, climate, resource availability with the farmers, decision making ability of the farmers under situation of changing prices and relative price of output of different crops. Low yield and long duration of existing varieties were replaced by improved varieties (Table 2).

### Effect of diversification on the productivity and returns of different crops

The per hectare production and net returns of all selected crops for the year of 2012-13 benchmark survey are given in table 3, and also for the year 2014-15. The per hectare production and net returns of benchmark crops paddy, soybean, maize (fodder), wheat, onion and chickpea was 16.00 q and Rs.19200, 14.00 q and Rs..19600, 135 q and Rs. 22200, 13.00 q and Rs.19500, 175.00 q and Rs.89250, 14.00 q and Rs.20300, respectively and after diversification per hectare production and net returns of crop paddy, soybean, maize (fodder), wheat, onion and chickpea was 18.00 q and Rs.28800, 15.00 q and Rs.25500, 201.00 q and

**Table 2: Benchmark status and diversified cropping pattern of sample farmers**

Sl. No.	Benchmark status of cropping pattern (2012-13)				Diversified cropping pattern (2014-15)			
	<i>Kharif</i>		<i>Rabi</i>		<i>Kharif</i>		<i>Rabi</i>	
	Name of crop	Variety	Name of crop	Variety	Name of crop	Variety	Name of crop	Variety
1	Groundnut	SB-11/Jalgaon	Onion	Puna Fursungi	Soybean	JS-335	Onion	N-2-4-1
2	Paddy	Darna	Chickpea	Vijay/local	Soybean	JS-335	Chickpea	Digvijay
3	Paddy	Darna	Wheat	HD-2189	Paddy	Phule Samrudhi	Wheat	NIAW-301
4	Soybean	Local/MACS-123	-	-	Soybean	JS-335	-	-
5	Grass	Local	-	-	Hybrid Napier	Phule Jayawant	-	-
6	Maize (fodder)	Panchganga	-	-	Maize (fodder)	African tall	-	-

**Table 3: Effect of diversification on productivity and returns (2012-13 &2014-15)**

Sr. No.	Name of crop	Benchmark status (2012-13)		Diversification (2014-15)		Percentage increase	
		Average productivity (q ha <sup>-1</sup> )	Net returns (Rs. ha <sup>-1</sup> )	Average productivity (q ha <sup>-1</sup> )	Net returns (Rs. ha <sup>-1</sup> )	Average productivity	Net returns
1	Paddy	16.00	19200	18.00	28800	12.50	50.00
2	Soybean	14.00	19600	15.00	25500	7.14	30.10
3	Groundnut	12.00	14400	0.00	0.00	0.00	0.00
4	Maize(fodder)	185.00	22200	201.00	25125	8.65	13.18
5	Wheat	13.00	19500	14.00	22400	7.69	14.87
6	Onion	175.00	89250	181.00	101269	3.43	13.47
7	Chickpea	14.00	20300	15.00	22500	7.14	10.84
8	Grass	16.00	759	0.00	0.00	0.00	0.00
9	Hy.napier	0.00	0.00	14.00	7000	0.00	0.00
	<b>Total</b>	-	<b>205209</b>	-	<b>232594</b>	-	<b>13.34</b>

Rs.25125, 14.00 q and Rs.22400, 181.00 q and Rs.101269, 15.00 q and Rs.22500, respectively.

As regards percentage increase in productivity and net returns, it was 12.50 and 50.00, 7.14 and 30.10, 8.65 and 13.18, 7.69 and 14.87, 3.43 and 13.47, 7.14 and 10.84 in case of paddy, soybean, maize (fodder), wheat, onion, chickpea crop due to diversification, respectively.

The comparing the Benchmark status Vs diversification, it is revealed that the Net returns from the crop component before diversification was Rs.205209 and after provision of technical knowledge about package of practices, it was increased by 13.34 per cent (Rs.232594) during the study period. Simmiler results were found by Gaikawad *et al.*(2007) and Gangawar *et al.* (2013).

#### Profitability from benchmark and diversified animal component

Before diversification, there was unavailability of improved semen for artificial insemination of Phule

Triveni. Milk production/animal/year was low and farmers were not aware about animal nutrition/ housing/ health/ cattle shed management/ hygienic milk production. The profitability from benchmark and diversified animal component are presented in Table 4. Before diversification, Milk production/cow and buffalo was 1761 litre and 819 litre, and net returns was Rs.14470 and after diversification i.e. provided improved breed semen for artificial insemination of Phule Triveni the and goat kid of Sangamneri / Osmanabadi, milk production of cow, buffaloes and goat was 2075 litre, 1052 litre and 309 litre, respectively in the year 2014-15. The gross returns and net returns from cow, buffaloes and goat were Rs. 39425 and Rs. 28062, Rs. 42080 and Rs. 33602, Rs. 4635 and Rs.1935, respectively.

As regards percentage increase in milk production was 17.83 and 28.45 per cent due to diversification in cow and buffaloes. Net returns from the animal

**Table 4: Profitability from existing and diversified animal component**

(Rs.animal <sup>-1</sup> year <sup>-1</sup> )						
Sr. No.	Animal	Milk (litre year <sup>-1</sup> animal <sup>-1</sup> )	Gross returns	Cost of rearing	Net returns	B:C ratio
<b>Benchmark status (2012-13)</b>						
1	Cows	1761	24654	10184	14470	2.42
2	Buffaloes	819	26204	7172	19032	3.65
3	Goats	-	0	0	0	0.00
	<b>Total</b>	<b>2120</b>	<b>50858</b>	<b>17356</b>	<b>33502</b>	<b>2.93</b>
<b>Diversified (2014-15)</b>						
1	Cows	2075	39425	11363	28062	3.47
2	Buffaloes	1052	42080	8478	33602	4.96
3	Goats	309	4635	2700	1935	1.72
	<b>Total</b>	<b>2623</b>	<b>86140</b>	<b>22541</b>	<b>63599</b>	<b>3.82</b>
<b>Per cent increase over benchmark</b>						
1	Cows	17.83	59.91	11.58	93.93	-
2	Buffaloes	28.45	60.59	18.21	76.56	-
3	Goats	0.00	0.00	0.00	0.00	-
	<b>Total</b>	<b>23.73</b>	<b>69.37</b>	<b>29.87</b>	<b>89.84</b>	

component before diversification were Rs. 33502 and after diversification, it was increased by 89.84 per cent. Total benefit cost ratio is also more in case of after diversification (3.82) as compare to that of Benchmark status (2.93). These results were similar with the results of Bhende *et al.*(1994) and Gill *et al.*(2005).

#### Profitability from product diversification

Technology related factors covering not only seed, fertilizers, marketing, storage but also processing. There was not equipment for grading the food grains

and for making the ghee from milk. Farmers get the low price for food grain and also lack of technical knowledge about value addition. To adopt the product diversification, farmers are provided knowledge for use of grading food grain sieve by supply of grading sieves to them and also provided equipment for ghee making for preparation of ghee. The profitability from product diversification is indicated in table 5.

The comparison of benchmark status and after diversification, before the diversification, soybean obtained after processing was 223 kg and total value of

the processed product was Rs.7607. After the diversification, soybean obtained after processing was 326 kg and total value of the processed product was Rs.12388. After the diversification, milk obtained after processing was 2.42 kg and total value of the processed milk product was Rs.725.

Total value from soybean and milk was increased by 72.38 per cent due to product diversification. These results were similar by Gangwar *et al.*(2013).

**Livelihood and nutritional security through diversification approach**

The livelihood and nutritional security through diversification approach is depicted in table 8. Generally edible oil, wheat, jowar, paddy, green gram, pigeon pea, potato, chicken/meat, egg and ghee were daily consumed by sample households. The expenditure on consumption of paddy is more (26.84 %) and followed by edible oil (16.13 %), wheat (13.96 %), greengram (16.13 %), jowar (10.16 %), chicken/meat (6.92 %), pigeon pea (6.18 %), potato (3.84 %), ghee (2.57 %) and egg (1.02 %). Similar result were noticed by Behera *et al.*(2014) and Gangwar *et.al.*(2013).

**Capacity building on different component**

The capacity building on different component indicated in table 7. Activities involved in capacity building for crop component was training of farmers on field crop production, providing technical knowledge of improved package of practices/ through folders/ krishi dairy, balance use of chemical fertilizers, arranging farmers’ visits to various agriculture exhibitions, visits to agriculture college farm, visits to mushroom production plant, visits to biofertilizer production plant, conducting field days, providing improved varieties of crops to selected farmers. Activities involved in capacity building for animal component were supply of Phule triveni semen for Artificial Insemination, supply of mineral mixture and goat kids of improved breed like sangamneri / osmanabad, providing technical knowledge of animal housing /nutrition/ breed/ health. Providing grading sieve /ghee making equipment to selected farmers for capacity building for product diversification. In case of capacity building for crop component, capacity building for animal component and capacity building for product diversification pre evaluation score (out of 100) before training was 45, 40 and 45 while post evaluation score (out of 100) after

**Table 5: Per farm profitability from product diversification** (Rs. animal<sup>-1</sup>year<sup>-1</sup>)

Sr.	Product	Benchmark status			After diversification			Value increased due to after diversification (%)
		Total product obtained after processing (kg)	Price of the processed product (Rs.kg <sup>-1</sup> lit <sup>-1</sup> .)	Total Value (Rs.)	Total product obtained after processing (kg)	Price of the processed product (Rs.kg <sup>-1</sup> lit <sup>-1</sup> .)	Total value (Rs.)	
1	Soybean	223	34	7607	326	38	12388	
2	Milk	-	-	-	2.42	300	725	
	<b>Total</b>			<b>7607</b>			<b>13113</b>	<b>72.38</b>

**Table 6: Livelihood and nutritional security through diversification approach** (Rs. animal<sup>-1</sup>year<sup>-1</sup>)

Sr. No.	Name of items	Quantity used <sup>-1</sup> year (kg)	Price (Rs. <sup>-1</sup> kg)	Total expenditure (Rs.)	Per cent
1	Edible oil	76	95	7220	18.07
2	Wheat	236	24	5664	14.18
3	Jowar	140	34	4760	11.91
4	Paddy	253	44	11132	27.86
5	Green gram	53	95	5035	12.60
6	Pigeon pea	25	73	1825	4.57
7	Potato	52	30	1560	3.90
8	Chicken/ meat	10	140	1400	3.50
9	Egg	60	5	300	0.75
10	Ghee	3	353	1059	2.65
	<b>Total</b>			<b>39955</b>	<b>100.00</b>

**Table 7: Capacity building on different component**

Sr. No.	Capacity building on different component	Name of training	Pre evaluation score (out of 100) before training	Post evaluation score (out of 100) after training	Cross income (Rs.) before training	Gross income (Rs.) after (6 months) training	Gross income increased due to training (Per cent)
1	Capacity building for crop component	a. Field crop production, b. Visits to various agriculture exhibitions c. Visits to agriculture college farm, d. Visits to mushroom production plant, e. Visits to biofertilizer production plant, conducting field days	45	75	205209	232594	13.34
2	Capacity building for animal component	Technical knowledge of animal housing /nutrition/ breed/ health	40	70	50858	86145	69.38
3	Capacity building for product diversification	Grading sieve /ghee making	45	80	7607	13113	72.38
<b>Total</b>					<b>263674</b>	<b>331852</b>	<b>25.85</b>

training was 75, 70 and 80, respectively. These results were noticed by Bhende *et al.*(1994) and Hadole *et al.*(2009).

Gross income before training was Rs. 205209, Rs.50858 and Rs.7607 in case of capacity building for crop component, capacity building for animal component and capacity building for product diversification, respectively and after training it was increased by 13.34, 69.38 and 72.38 per cent, respectively. The comparison of capacity building on different component, the total gross income before training (Rs.263674) is comparatively less than gross income after six months after training (Rs.331852). Similar results were reported by Malthes *et al.* (2009) and Sachinkumar *et al.*(2012).

#### **Constraints in crop, animal and product diversification**

The major constraints in crop diversification identified were, Unavailability of improved variety seeds, imbalanced fertilizer use by the farmers, unavailability of mineral mixtures, unavailability of improved breed and lack of technical knowledge about feeding/ animal nutritional and housing, etc.

The comparative analysis of all net returns components of existing farming systems before diversification was less than that of after diversification.

After diversification the net returns from crop component, animal component and product processing were increased by 13.34, 69.38 and 72.38 per cent, respectively, and total gross income after capacity building on different components increased by 25.85 per cent and the diversification component provides employment for the farm family throughout the year. Thus, diversification of existing farming systems was profitable and increase the output with cost reduction.

#### **REFERENCES**

- Behera, U. K., Kaechele H. and France J., 2014. Integrated animal and cropping systems in single and multi-objective frameworks for enhancing the livelihood security of farmers and agricultural sustainability in Northern India. *Animal Prod. Sci.*, **55**(10) 1338-46.
- Behera, U.K., Sharma, A.R.and Mahapatra, I.C., 2007. Crop diversification for efficient resource management in India: problems, prospects and policy. *J. Sustainable Agric.*, **30**,:97-127.
- Bhende, M.J. and Venkataram, J.V. 1994. Impact of diversification of household income and risk: a whole farm modeling approach. *Agril. Systems*, **44** : 301-12.

- Bindhu, J. S., Raj S. K. and Girijadevi L., 2014. Sustainable system intensification of sesamum (*Sesamum indicum*) through legume intercropping in sandy loam tract of Kerala, *J. Crop Weed*, 10 : 38-42.
- Gaikawad, C.B., Hile R.B., Patil Y.J. and Wani A.G., 2007. Economics of diversification of existing cropping system in scarcity zone area of Ahemdnagar in Maharashtra, 3<sup>rd</sup> Nat. Symp. Int. Farm. Syst., 26-28, Oct.: 299-300.
- Gangwar, B. and Ravisankar N., 2013. Making Agriculture Profitable through Farming Systems Approach, *Nat. Conf. Making Agric. Profitable*, 26-27 July 2013, RVSKVV, Gwalior, Madhya Pradesh & M.P., Bhopal, pp 98-112.
- Gangwar, B. and Ravisankar, N., 2013. Diversified cropping systems for food security. *Indian Farm.*, **63** : 3-7.
- Gill, M.S., Samra, J.S., and Singh, G., 2005. Integrated farming system for realizing high productivity under shallow water table conditions.' *Res. Bull. Punjab Agric. Uni.* pp. 70.
- Hadole, S.M., and Tawade N.D., 2009. *Economics of Farming System in Ratanagiri District of Konkan Region*. Agriculture Update, 4 : 356-61.
- Mahapatra, I.C., and Behera, U.K., 2004. Methodologies of farming systems research. In *Recent Advances in Rice-based Farming Systems*, Cuttack, Orissa, 17-19 Nov. 2004'. pp. 79-113.
- Malthesh G.B., Shivamurthy M. and Reddy B.S.L., 2009. Factors contributing towards socio-economic performance among the farmers on selected farming systems in eastern dry Zone of Karnataka. *Mysore J. Agril. Sci.*, **43** : 530-36.
- Sachinkumar, T.N., Basavraja H., Kunnal L.B., Kulkarni G.N., Mahajanashetty S.B., Hunshal C. S. and Hosamani S.V., 2012. Economic of farming Ssystem in northern transitional zone of Karanataka. *Karanataka J. Agrc. Sci.*, **25** : 350-58.