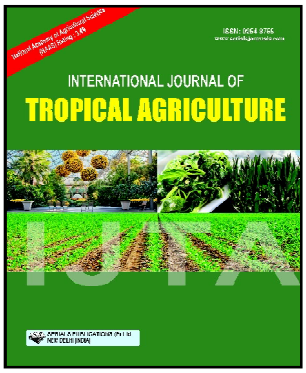

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Impact of Organic Farming Production Method on Vegetables Productivity in Himachal Pradesh

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Abstract: Organic farming production method emphasizes on the maintenance of the soil health and protecting ecosystem by adopting chemical free farming and to develop a living relationship of trust and purity among people and crops. This method belies on biological processes, biodiversity and cycles adapted to local conditions rather than the use of inputs with adverse effects on crops. Hence, organic farming combines traditional knowledge of farming with innovations suitable to local conditions, along with scientific understanding of farm practices which ensures good quality of life for all living creatures. The analysis reveals that the productivity of peas were benefited highly from organic farming production methods, while beans got medium impact, tomato had low impact and capsicum got negligible response on sample farms in the study area.

Key words: Organic farming production method, relative production method index.

JEL classification: Q00, Q010

INTRODUCTION

India has a deep philosophy of agriculture portrayed in Krishi-Parashara a treatise on ancient Indian agriculture written in Sanskrit. In this treatise sage Parashara in the verses on importance of agriculture said, "One may wear gold (ornaments) around the neck, in the ear, and on the hand, and yet may suffer from hunger in the absence of food. Food is life, food is also the strength, and food is everything. The divines, the demons, and the humans all live on food". Further in the verses on management of farm sage Parashara said, "Farms yield gold if properly managed but lead to poverty if neglected. An agriculturist who looks after the welfare of his cattle, visits his farms daily, has the knowledge of seasons, is careful about the seeds, and is industrious is

rewarded with good harvest and never perishes. Only the capable, motivated by the welfare of people should undertake farming. An incapable farmer lands himself in poverty" (Sadhale, 1999). It seems that in present time organic farming servers the same purposes, because healthy soil, healthy food, healthy people, and environmental sustainability are the core concerns of organic farming (NCOF, Ghaziabad). Organic farming works in harmony with nature. It is a farm management technique to achieve good crop yields without harming the nature environment or people who live and work in it. There are following farm management practices in organic farming as:

1. To keep and build good soil structure and fertility by; (a) recycled and composted crop waste and animal manures, (b) crop rotation, (c) Green manures and legumes, and (d) Mulching on the soil surface.
2. To control pests, diseases and weeds by; (a) careful planning and crop choice, (b) the use of resistant crops, (c) good cultivation practice, (d) crop rotation, (e) encouraging useful predators (natural enemies) that eat pests, (f) increasing genetic diversity, and (g) using natural pesticides.
3. Organic farming farm management practices also involves; (a) careful use of water resources, and (b) good animal husbandry.

In the rural economy of Himachal Pradesh, agriculture still plays the role of the mother of all farm and non-farm activities. The action plan for the development of rural economy to ameliorate socio-economic conditions of the people in the State should on the one hand focus primarily on agricultural diversification through horticultural crops especially for small and marginal farmers, who constitute 87.03 per cent of total land holdings in the State, and on the other hand, develop appropriate production technology for the rain-fed farming system of this hill state. The cultivation of high value crops such as vegetables give very high net returns and has made a significant impact on the income and employment levels of all the categories of cultivating households in the State (Sharma, 2011). Some districts like Shimla, Sirmour, Solan, Kangra, Mandi, Chamba and Kullu, whose part of area come under Mid Hills Zone and High Hills Zone are highly profitable areas of vegetable production. According to an estimate, the area under vegetables increased from 34.15 to 72.00 thousand hectares, with a positive compound growth rate of 6.14 per cent per annum during years 2001-02 to 2013-14, a simultaneous increase in production of vegetables was from 627.45 to 1465.96 thousand metric tons (MT), having positive compound growth rate of 7.40 per cent per annum during the same years. Though there have been significant positive compound growth rates at 1 per cent level of probability in productivity of principal vegetables in the State, these growth rates have far smaller magnitude than that of area and production of vegetables during years 2001-02 to 2013-14 (Table 1). This indicates that the increase in production of vegetables is mainly the outcome of area augmentation. The productivity levels have not risen as strongly as the area and production mainly due to low level of technology infusion and lack of irrigation. Nearly similar trends in productivity growth have been found at district level. During year 2013-14, the highest productivity of beans was in district Solan (17.00 MT/ha), followed by Bilaspur (16.00 MT/ha), and Kangra (13.60 MT/ha), respectively. The highest productivity of cabbage was in district Bilaspur (41.25 MT/ha), followed by Shimla (39.23 MT/ha), and Kangra (38.71 MT/ha), respectively. The productivity of capsicum was highest in district Bilaspur (41.98 MT/ha) followed by Chamba (25.83 MT/ha), and Solan (19.00 MT/ha) districts, respectively. District Chamba had highest productivity of cauliflower (31.00 MT/ha), followed by Lahaul & Spiti (28.09 MT/ha), and Solan (27.00 MT/ha), respectively. The

productivity levels of other vegetables have also been presented in the Table 1. During year 2013-14 the productivity of total vegetables (principal vegetables and other miscellaneous vegetables) was highest in district Solan (31.58 MT/ha), followed by Bilaspur (27.06 MT/ha), and Sirmour (22.32 MT/ha), respectively. At State level among principal vegetables the growth rates in productivity of capsicum was highest, followed by tomato, cabbage, peas, cauliflower, and beans (Table 1).

Apart from conventionally known vegetables growing districts viz., Shimla and Solan the better performance of Bilaspur, Hamirpur, Kangra and Chamba districts in the productivity of principal vegetables, highlights the consolidated impact of crop diversification initiatives in the State, which encompasses the development programmes to enhance soil fertility, promotion of micro-irrigation, precision farming through polyhouses, and developing marketing and basic infrastructure like rural roads etc.

METHODOLOGY

Design of sample

Multi-stage sampling technique has been used for the selection of study sample. Selection of districts is the first stage of sampling, selection of blocks is the second followed by the selection of revenue villages. The selection of sample households from the selected revenue villages has been the last stage of sampling.

Selection of Vegetables for the Study

There was 67968 hectare area under vegetables (excluding potato) in the State during year 2011-12 (study year). Peas, tomato, capsicum, beans, cabbage, and cauliflower are the main vegetables with 23672 hectare (29.66 %), 9870 hectare (12.37 %), 2027 hectare (2.54 %), 3295 hectare (4.13 %), 4349 hectare (5.45 %), and 4180 hectare area (5.24 %), respectively, in total vegetables area (Table 2). In district Shimla area under peas, tomato, capsicum, beans, cabbage, and cauliflower was 6364, 535, 256, 678, 1579, and 1516 hectare, respectively, which was 34.90 per cent, 2.93 per cent, 1.40 per cent, 3.72 per cent, 8.66 per cent, and 8.31 per cent, respectively, to total vegetable area in this district. In district Solan area under peas, tomato, capsicum, beans, cabbage, and cauliflower comprised of 1215, 4292, 907, 488, 69, and 136 hectare, respectively, which was 13.96 per cent, 49.30 per cent, 10.42 per cent, 5.61 per cent, 0.79 per cent, and 1.56 per cent, respectively to total vegetable area in this district (Table 3). This indicates the importance of these vegetables in the State as whole and related districts as well. Therefore, keeping in view the above facts, the vegetables peas, beans, capsicum, and tomato have been selected for detailed study.

Selection of districts

Shimla and Solan Districts of Himachal Pradesh were selected, taking into account the large number of farmers registered under organic agriculture programme here. Both districts are known for vegetables production, and some ground work has been done by service providers (NGOs) in the promotion of organic farming also. There were 24338 farmers registered under organic agriculture programme in twelve districts of Himachal Pradesh up to 2011-12. Among twelve districts Shimla and Solan districts accounted for 33.08 per cent (8085) and 22.19 per cent (5400) farmers (Table 4). In vegetable production, district Shimla accounted 18236 hectare (22.85 %), and district Solan accounted 8706 hectare (10.91 %) out of total area under vegetables in the State during year 2011-12. Both districts are leading in the vegetables production in the State (Table 5).

Selection of blocks and sample households

Two blocks from Shimla and Solan districts each were selected purposively. From selected four

Table 1

District-wise trends in area, production and yield of principal vegetables in Himachal Pradesh

(Area (A.) in '000'ha, Production (P.) in '000'MT, Productivity (Y.) in MT/ha)

Particular	*Beans*			*Cabbage*			*Capsicum*			*Cauliflower*			*Peas*			*Tomato*			*Total vegetables*		
	A.	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*
Bilaspur																					
2001-02	0.08	0.70	9.33	0.05	1.13	25.00	0.16	1.39	8.97	0.08	1.36	17.00	0.10	0.95	9.45	0.27	8.60	31.85	1.62	29.02	17.91
	(3.56)	(3.17)		(2.25)	(1.96)		(9.64)	(9.00)		(5.80)	(5.44)		(1.02)	(1.01)		(3.83)	(3.53)		(4.74)	(4.62)	
2013-14	0.08	1.20	16.00	0.03	1.32	41.25	0.06	2.44	41.98	0.15	3.58	24.66	0.10	1.55	16.32	0.73	27.34	37.45	2.69	72.88	27.06
	(2.13)	(2.59)		(0.66)	(0.86)		(2.66)	(6.18)		(3.30)	(3.58)		(0.42)	(0.57)		(7.02)	(6.35)		(3.74)	(4.97)	
C.G.R.	2.88**	6.37*	3.82*	"0.096^{NS}	4.46*	3.98*	"4.23**	7.71*	11.62*	5.26*	5.93*	0.66^{NS}	"0.16^{NS}	1.47^{NS}	1.82^{NS}	3.44^{NS}	6.20*	2.77*	3.47*	6.68*	3.21*
t-value	2.33	6.38	6.92	"0.05	3.76	5.15	"2.02	2.62	6.59	6.17	4.94	0.68	"0.23	0.82	0.83	1.70	3.35	3.74	11.70	10.71	6.98
Chamba																					
2001-02	0.25	2.45	9.80	0.11	2.75	25.00	0.07	0.63	8.93	0.03	0.44	17.40	0.33	2.80	8.48	0.06	1.80	30.00	1.40	20.12	14.36
	(11.11)	(11.11)		(4.95)	(4.77)		(4.22)	(4.08)		(2.17)	(1.76)		(3.35)	(2.97)		(0.85)	(0.74)		(4.10)	(3.21)	
2013-14	0.45	6.32	14.01	0.13	3.85	29.17	0.01	0.31	25.83	0.02	0.65	31.00	1.82	25.53	14.02	0.25	9.31	38.00	3.16	56.37	17.84
	(12.00)	(13.63)		(2.85)	(2.50)		(0.44)	(0.78)		(0.44)	(0.65)		(7.61)	(9.42)		(2.41)	(2.16)		(4.39)	(3.85)	
C.G.R.	0.14^{NS}	1.26^{NS}	1.16^{NS}	"2.58^{NS}	"2.58^{NS}	"0.84^{NS}	"17.35*	"8.35**	8.26*	2.49^{NS}	9.23*	5.52*	14.89*	22.38*	7.46*	8.00*	10.57*	1.90**	7.48*	10.54*	3.04*
t-value	0.05	0.48	0.93	"0.70	"0.77	"0.47	"3.52	"2.27	4.71	0.84	2.72	5.30	839	6.82	3.26	2.41	3.08	2.04	10.01	7.39	2.31
Hamirpur																					
2001-02	0.09	0.81	9.00	0.02	0.54	27.00	0.05	0.44	8.80	0.05	0.85	17.00	0.09	0.70	7.78	0.10	3.05	30.50	1.03	16.80	16.31
	(4.00)	(3.67)		(0.90)	(0.94)		(3.01)	(2.85)		(3.62)	(3.40)		(0.91)	(0.74)		(1.42)	(1.15)		(3.02)	(2.68)	
2013-14	0.09	0.86	9.56	0.06	0.82	14.91	0.05	0.66	13.55	0.28	4.45	15.89	0.17	1.20	7.27	0.12	5.44	46.10	3.61	55.39	15.36
	(2.40)	(1.85)		(1.32)	(0.53)		(2.22)	(1.67)		(6.17)	(4.45)		(0.71)	(0.44)		(1.25)	(1.26)		(5.01)	(3.78)	
C.G.R.	–1.26^{NS}	–2.68^{NS}	–1.22^{NS}	11.53*	5.81**	–5.75*	–5.30^{NS}	–5.02^{NS}	0.38^{NS}	15.16*	13.08*	–2.16*	6.26*	3.45*	–2.68**	0.69^{NS}	6.79*	6.85*	11.65*	9.78*	–1.88**
t-value	–0.93	–0.98	–0.80	4.88	2.02	–5.19	–0.99	–0.61	0.12	11.22	12.15	–3.05	9.89	3.47	–2.18	0.09	3.57	3.15	12.75	11.41	–2.06
Kangra																					
2001-02	0.27	2.55	9.44	0.09	2.28	25.28	0.14	1.27	9.07	0.12	2.16	18.00	0.27	2.43	9.00	0.25	7.75	31.00	2.70	45.55	16.87
	(12.00)	(11.56)		(4.05)	(1.48)		(8.43)	(8.22)		(8.70)	(8.64)		(2.74)	(2.58)		(3.55)	(3.18)		(7.91)	(7.26)	
2013-14	0.49	6.69	13.60	0.38	14.83	38.71	0.15	2.24	15.02	0.53	12.29	23.18	0.73	8.33	11.46	0.48	19.13	40.26	8.05	169.43	21.05
	(13.07)	(14.42)		(8.33)	(9.64)		(6.66)	(5.67)		(11.67)	(12.28)		(3.05)	(3.07)		(4.62)	(4.44)		(11.18)	(11.56)	
C.G.R.	5.64*	8.64*	2.91**	9.35*	13.85*	4.39*	–2.14^{NS}	–0.68^{NS}	1.22^{NS}	7.20***	11.87*	4.75*	6.88*	10.83*	3.92*	4.57*	6.41*	1.82*	7.61*	9.80*	2.18*
t-value	5.48	5.83	2.28	3.53	5.01	4.20	–0.74	–0.18	0.69	1.75	3.42	2.89	8.76	8.46	3.25	13.14	5.82	1.81	4.55	7.47	3.50
Kinnaur																					
2001-02	0.18	1.77	9.83	0.07	1.85	28.46	0.00	0.00	0.00	0.02	0.35	17.50	0.65	6.50	10.00	0.02	0.57	28.50	1.06	12.83	12.10
	(8.00)	(8.03)		(3.15)	(3.21)		(0.00)	(0.00)		(1.45)	(1.40)		(6.61)	(6.90)		(0.28)	(0.23)		(3.10)	(2.04)	
2013-14	0.37	4.09	11.20	0.13	2.50	18.78	0.03	0.39	15.00	0.08	1.20	16.00	2.35	24.20	10.30	0.08	2.08	27.73	3.49	42.48	12.16
	(9.87)	(8.82)		(2.85)	(1.62)		(1.33)	(0.99)		(1.76)	(1.20)		(9.83)	(8.93)		(0.77)	(0.48)		(4.85)	(2.89)	
C.G.R.	5.98*	7.38*	1.47*	7.17*	6.29*	–1.13^{NS}	16.65*	13.89***	–0.61^{NS}	13.60*	1.62^{NS}	–11.03^{NS}	9.05*	9.22*	0.17^{NS}	14.45*	26.23*	11.72**	9.11*	10.86*	1.74*
t-value	6.75	8.38	2.43	4.19	2.39	–0.63	2.38	1.88	–0.88	3.84	0.33	–1.80	4.93	4.43	0.39	4.92	4.16	2.05	6.07	7.32	2.61

contd. table 1

Particular	Beans			Cabbage			Capsicum			Cauliflower			Peas			Tomato			Total vegetables		
	A.	P.	Y.	A.	P.	Y.	A.	P.	Y.	A.	P.	Y.	A.	P.	Y.	A.	P.	Y.	A.	P.	Y.
Kullu																					
2001-02	0.15 (6.67)	1.44 (6.53)	9.60	0.42 (18.92)	10.92 (18.93)	26.00	0.15 (9.04)	1.36 (8.80)	9.07	0.35 (25.36)	6.40 (25.61)	18.29	0.40 (4.07)	3.90 (4.14)	9.75	0.65 (9.22)	21.10 (8.65)	32.46	3.33 (9.75)	65.24 (10.39)	19.59
2013-14	0.13 (3.47)	1.30 (2.80)	9.77	0.81 (17.76)	24.54 (15.95)	30.37	0.07 (3.11)	0.89 (2.25)	12.12	0.65 (14.32)	12.33 (12.32)	19.06	1.73 (7.24)	22.22 (8.20)	12.82	0.66 (6.35)	24.10 (5.59)	36.74	5.59 (7.76)	108.37 (7.39)	19.37
C.G.R.	1.71***	3.94***	1.91***	5.45*	8.12*	2.63**	–7.11*	–2.65***	3.90*	4.77*	4.68*	–0.08^{NS}	13.03*	15.65*	2.54*	–0.42^{NS}	2.13^{NS}	2.57**	4.34*	5.91*	1.56^{NS}
t-value	1.70	1.88	1.47	3.46	3.39	1.97	–3.77	–1.52	4.42	7.24	2.49	–0.06	14.26	8.68	2.51	–0.65	1.27	1.83	32.81	4.21	1.17
Lahaul & Spiti																					
2001-02	0.03 (1.33)	0.28 (1.28)	9.17	0.03 (1.35)	0.65 (1.13)	26.00	0.00 (0.00)	0.00 (0.00)	0.00	0.02 (1.45)	0.16 (0.64)	8.00	2.00 (20.33)	20.10 (21.34)	10.05	0.02 (0.28)	0.40 (0.16)	26.67	2.16 (6.32)	22.57 (3.60)	10.45
2013-14	0.02 (0.53)	0.14 (0.30)	7.78	0.03 (0.66)	0.59 (0.38)	18.31	0.003 (0.13)	0.02 (0.05)	6.33	0.07 (1.54)	1.88 (1.88)	28.09	3.96 (16.56)	38.05 (14.04)	9.61	0.004 (0.04)	0.07 (0.02)	18.00	4.21 (5.85)	43.42 (2.96)	10.31
C.G.R.	–4.02***	–7.40*	–1.26^{NS}	1.61^{NS}	2.74^{NS}	0.78^{NS}	4.26^{NS}	–3.06^{NS}	–7.92*	7.48*	14.14*	7.06*	3.85*	2.46^{NS}	–1.39**	–7.24*	–3.05^{NS}	–0.47^{NS}	3.83*	2.77***	–1.07**
t-value	–1.77	–4.73	–1.03	0.82	0.65	0.23	0.54	–0.28	–2.81	4.05	5.68	3.84	2.78	1.23	–2.14	–2.57	–0.74	–0.22	2.85	1.53	–1.98
Mandi																					
2001-02	0.27 (12.00)	2.60 (11.79)	9.63	0.11 (4.95)	2.82 (4.90)	25.64	0.16 (9.64)	1.47 (9.51)	9.19	0.11 (7.97)	2.00 (8.00)	18.18	1.05 (10.67)	9.00 (9.56)	8.61	0.27 (3.83)	8.90 (3.65)	32.96	3.32 (9.72)	50.36 (8.03)	15.17
2013-14	0.39 (10.4)	3.92 (8.45)	10.00	0.99 (21.71)	28.75 (18.69)	29.04	0.26 (11.54)	4.03 (10.20)	15.50	0.72 (15.86)	15.90 (15.89)	22.08	3.60 (15.06)	45.03 (16.61)	12.50	0.78 (7.50)	27.15 (6.30)	35.03	10.18 (14.14)	199.12 (13.58)	19.57
C.G.R.	3.42*	3.65**	0.16^{NS}	22.89*	23.94*	1.07^{NS}	4.84*	7.20*	2.26**	17.59*	19.29*	1.59^{NS}	12.18*	15.29*	3.10*	–0.62^{NS}	4.65**	5.29**	8.79*	11.27*	2.48*
t-value	4.21	2.08	0.14	7.70	7.28	1.02	6.07	8.40	2.58	10.17	7.47	0.93	13.56	16.92	4.42	“0.19	1.95	2.06	11.71	15.55	3.07
Shimla																					
2001-02	0.34 (15.11)	3.60 (16.33)	10.59	1.07 (48.20)	28.49 (49.40)	26.63	0.28 (16.87)	2.60 (16.83)	9.29	0.36 (26.09)	7.02 (28.09)	19.49	2.70 (27.44)	26.09 (27.70)	9.66	0.66 (9.36)	21.50 (8.81)	32.82	6.14 (17.98)	101.12 (16.12)	16.47
2013-14	0.77 (20.53)	8.17 (17.62)	10.66	1.62 (35.52)	63.43 (41.23)	39.23	0.30 (13.32)	4.46 (11.29)	15.12	1.58 (34.80)	38.26 (38.23)	24.22	6.50 (27.19)	71.65 (26.43)	11.02	0.57 (5.48)	23.87 (5.54)	41.73	12.64 (17.55)	231.02 (15.77)	18.28
C.G.R.	7.12*	7.10*	0.00^{NS}	2.86**	5.14*	2.28*	0.21^{NS}	2.38^{NS}	2.28*	11.92*	13.11*	1.16*	8.45*	9.81*	1.35*	–1.23***	0.37^{NS}	1.58*	6.82*	6.68*	–0.14^{NS}
t-value	22.49	22.95	0.30	2.68	4.26	5.28	0.13	1.25	3.24	4.41	4.66	4.37	10.49	14.44	2.99	–1.41	0.46	3.42	17.76	17.49	–0.45
Sirmour																					
2001-02	0.21 (9.33)	2.00 (9.07)	9.52	0.12 (5.40)	3.05 (5.29)	25.42	0.21 (12.65)	1.95 (12.62)	9.26	0.11 (7.97)	1.99 (7.96)	18.09	1.13 (11.48)	10.75 (11.41)	9.56	1.60 (22.70)	53.60 (21.97)	33.50	4.37 (12.80)	90.53 (14.43)	20.72
2013-14	0.41 (10.93)	4.61 (9.94)	11.14	0.23 (5.04)	8.91 (5.79)	38.55	0.28 (12.43)	4.49 (11.36)	16.20	0.21 (4.63)	3.50 (3.50)	16.66	1.63 (6.82)	17.58 (6.49)	10.77	2.16 (20.78)	88.04 (20.44)	40.80	7.79 (10.82)	173.78 (11.85)	22.32
C.G.R.	7.69*	8.33*	0.60***	5.89*	8.29*	2.25**	2.79^{NS}	6.30*	3.54*	6.74*	4.87*	“1.98*	1.32^{NS}	2.63**	1.28*	3.25*	5.84*	2.60*	4.90*	6.33*	1.43*
t-value	6.14	7.00	1.64	7.24	11.78	2.60	1.28	2.85	5.84	11.99	11.62	“3.94	1.06	1.98	4.00	4.88	5.92	5.27	18.04	10.96	2.76

contd. table 1

Particular	*Beans*			*Cabbage*			*Capsicum*			*Cauliflower*			*Peas*			*Tomato*			*Total vegetables*		
	A.	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*	*A.*	*P.*	*Y.*
Solan																					
2001-02	0.34	3.52	10.34	0.09	2.19	25.76	0.39	3.92	10.04	0.06	1.10	18.33	1.08	10.60	9.81	3.10	115.38	37.22	6.01	155.05	25.80
	(15.11)	(15.96)		(4.05)	(3.79)		(23.49)	(25.37)		(4.35)	(4.40)		(10.98)	(11.26)		(43.97)	(47.30)		(17.60)	(24.71)	
2013-14	0.50	8.52	17.00	0.07	2.45	34.00	1.00	19.08	19.00	0.15	4.08	27.00	1.27	15.24	12.00	4.45	200.30	45.00	8.98	283.60	31.58
	(13.33)	(18.37)		(1.53)	(1.59)		(44.39)	(48.29)		(3.30)	(4.08)		(5.31)	(5.62)		(42.81)	(46.49)		(12.47)	(19.35)	
C.G.R.	5.95**	11.06*	4.99*	–2.06**	3.59***	5.39*	10.48*	17.29*	6.77*	7.14*	12.32*	4.95*	1.76^{NS}	3.01**	1.27**	2.71*	5.59*	2.86*	4.07*	6.48*	2.40*
t-value	2.09	2.75	3.67	"2.63	2.14	3.06	6.99	8.07	7.35	7.81	6.18	2.83	1.33	1.80	1.90	8.94	9.20	4.99	7.15	8.76	6.10
Una																					
2001-02	0.04	0.33	9.43	0.04	1.00	25.00	0.05	0.42	9.22	0.07	1.16	17.85	0.04	0.36	9.00	0.05	1.30	28.89	1.01	18.24	18.06
	(1.78)	(1.50)		(1.80)	(1.73)		(3.01)	(2.72)		(5.07)	(4.64)		(0.41)	(0.38)		(0.71)	(0.53)		(2.96)	(2.91)	
2013-14	0.05	0.55	10.78	0.08	1.84	24.55	0.04	0.50	13.62	0.10	1.96	19.64	0.05	0.49	9.78	0.11	3.97	34.79	1.61	30.10	18.66
	(1.33)	(1.18)		(1.75)	(1.19)		(1.78)	(1.27)		(2.20)	(1.96)		(0.21)	(0.18)		(1.06)	(0.92)		(2.24)	(2.05)	
C.G.R.	2.62*	3.99*	0.81^{NS}	4.27*	3.26*	–0.82^{NS}	–2.21^{NS}	0.08^{NS}	2.58*	3.13*	4.13*	0.77^{NS}	2.23**	2.95*	0.87*	7.52*	14.36*	6.00*	3.90*	4.05*	0.13^{NS}
t-value	2.90	2.93	0.91	6.35	3.96	–1.29	–1.02	0.04	4.55	4.75	5.72	1.12	2.09	2.49	3.66	9.19	4.78	2.57	11.80	10.57	0.32
Himachal Pradesh																					
2001-02	2.25	22.05	9.80	2.22	57.67	25.98	1.66	15.45	9.35	1.38	24.99	18.23	9.84	94.18	9.58	7.05	243.95	34.70	34.15	627.45	18.37
	(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)	
2013-14	3.75	46.37	12.37	4.56	153.83	33.73	2.253	39.51	17.61	4.54	100.08	22.11	23.91	271.07	11.34	10.394	430.8	41.53	72.00	1465.96	20.36
	(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)		(100.0)	(100.0)	
C.G.R.	4.56*	5.91*	1.37*	6.33*	8.10*	1.76*	3.20*	7.44*	4.25*	10.20*	11.64*	1.43*	7.47*	8.91*	1.44*	1.84*	5.21*	3.36*	6.14*	7.40*	1.26*
t-value	8.34	13.60	4.03	6.46	7.67	4.54	2.60	4.95	6.08	21.38	13.48	2.37	8.89	8.42	4.84	3.60	14.41	4.73	13.39	18.06	5.25

Source: Directorate of Agriculture, H.P.

Note: Figures in parenthesis are the percentage to respective totals

NS – Non-significant

* significant at 1 per cent level of significance

** significant at 5 per cent level of significance

*** significant at 10 per cent level of significance

blocks of Shimla and Solan districts, revenue villages were selected purposively. From the selected revenue villages a random sample of 200 organic farm households and 100 conventional farm households as a control sample was taken to facilitate the comparison and working out the impact and relevance of organic vegetables production. Households were divided into three classes on the basis of the size of their holdings viz., marginal farms (up to 1 hectare), small farms (1 to 2 hectare), and other farms (above 2 hectare).

Table 2
Areas under vegetables in Himachal Pradesh during 2011-12

(Area in Hectare)

Sr.No.	*Vegetable crop*	*Area*	*% of Total*	*% of Sub-total*
1.	**Peas**	23672	29.66	34.83
2.	**Tomato**	9870	12.37	14.52
3.	**Capsicum**	2027	2.54	2.98
4.	**Beans**	3295	4.13	4.85
5.	**Cabbage**	4349	5.45	6.40
6.	**Cauliflower**	4180	5.24	6.15
7.	**Other vegetables**	20575	25.78	30.27
Sub-total		67968	85.17	100.00
8.	**Potato**	11838	14.83	
Total vegetables		79806	100.00	

Source: Directorate of Agriculture, Himachal Pradesh

Table 3
Areas under vegetables in Shimla and Solan Districts during 2011-12

(Area in Hectare)

Sr.No.	*Vegetable crop*	*Shimla District*			*Solan District*		
		Area	*% of Total*	*% of Sub-total*	*Area*	*% of Total*	*% of Sub-total*
1.	**Peas**	6364	34.90	53.10	1215	13.96	14.30
2.	**Tomato**	535	2.93	4.46	4292	49.30	50.51
3.	**Capsicum**	256	1.40	2.14	907	10.42	10.67
4.	**Beans**	678	3.72	5.66	488	5.61	5.74
5.	**Cabbage**	1579	8.66	13.17	69	0.79	0.81
6.	**Cauliflower**	1516	8.31	12.65	136	1.56	1.60
7.	**Other vegetables**	1058	5.80	8.83	1391	15.98	16.37
Sub-total		11986	65.73	100.00	8498	97.61	100.00
8.	**Potato**	6250	34.27		208	2.39	
Total vegetables		18236	100.00		8706	100.00	

Source: Directorate of Agriculture, Himachal Pradesh

Table 4
District-wise number of farmers registered under organic farming up to 2011-12 in Himachal Pradesh

Sr.No.	*Name of District*	*Number of farmers registered*	*% of total*
1.	**Bilaspur**	1200	4.93
2.	**Chamba**	429	1.76
3.	**Hamirpur**	1800	7.40
4.	**Kangra**	2050	8.42
5.	**Kinnaur**	246	1.01
6.	**Kullu**	1591	6.54
7.	**Lahaul Spiti**	211	0.87
8.	**Mandi**	2569	10.56
9.	**Shimla**	8050	33.08
10.	**Sirmour**	400	1.64
11.	**Solan**	5400	22.19
12.	**Una**	392	1.61
	Total	**24338**	**100.00**
	Area covered = 12000 Ha.		

Source: Directorate of Agriculture, Himachal Pradesh

Period of the study

The present study pertained to the agricultural year 2011-12, starting from 1st July to 30th June.

Analytical tools

Production of vegetable crop is influenced by many inputs or factors of production; therefore to measure the aggregate impact of these inputs on vegetable yield an index is developed, which would assess relative intensity of inputs used and their impact on yield on sample organic farms. This index is called Relative production method index. It is an index of relative production method on organic farms taking conventional farms production method as a base. To understand this, a following index is developed as below:

$$PMI = \frac{\Sigma_{j=1}^{k} \frac{PO_{ij}}{PIN_j} \times 100}{N}$$

$\{i=1, 2, 3 \ldots.k\}, \{j=1, 2, 3\ldots.N\}$

Where

PMI = Relative production method index,

PO_{ij} = jth input units used on ith organic farm,

PIN_j = Mean of jth input units used on conventional farms

N = Number of input used in production of crop

RESULTS AND DISCUSSIONS

Impact of organic farming on productivity of vegetables

An index Relative Production Method Index has been developed to assess the impact of organic farming on the yield of vegetables as compare to conventional farming. The Relative Production Method Index in short PMI for selected vegetables has been presented in the Table 6, wherein, PMI is the arithmetic mean index of all considered input indices on different size of organic farms. The arithmetic mean is calculated for the composite index of production method on organic farms. Through this index (PMI), an attempt has been made to evaluate the impact of organic farming production method (with the use of same set of inputs on conventional farms, while other inputs remained constant) on the yield of selected vegetables on different size of organic farms.

(A) Peas

Marginal farms: The yield of peas increased by 16.48 per cent (yield index of 116.48) as compared to conventional farms (mean of peas yield on conventional farms taken as base). However, seed rate used on an average increased by 9.61 per cent, on marginal organic farms. The human-labour hours required per hectare on organic farms declined by 25.93 per cent as compared to conventional farms. The bullock labour use in organic peas farming

Table 5
District-wise area under vegetables in Himachal Pradesh during 2011-12

(Area in Hectare)

Sr.No.	*Districts*	*Peas*	*Tomato*	*Capsicum*	*Bean*	*Cabbage*	*Cauliflower*	*Other vegetables*	*Sub-total (1 to 7)*	*Potato*	*Total vegetables*
1.	**Bilaspur**	80	760	60	70	31	136	1398	2535	30	2565
		(0.34)	(7.70)	(2.96)	(2.12)	(0.71)	(3.25)	(6.76)	(3.73)	(0.25)	(3.21)
2.	**Chamba**	2051	93	5	287	100	25	389	2950	557	3507
		(8.66)	(0.94)	(0.25)	(8.71)	(2.30)	(0.60)	(1.88)	(4.34)	(4.71)	(4.39)
3.	**Hamirpur**	151	99	33	76	101	235	2405	3100	21	3121
		(0.64)	(1.00)	(1.63)	(2.31)	(2.32)	(5.62)	(11.62)	(4.56)	(0.18)	(3.91)
4.	**Kangra**	621	413	143	363	351	530	4955	7376	3	7379
		(2.62)	(4.18)	(7.05)	(11.02)	(8.07)	(12.68)	(23.94)	(10.85)	(0.03)	(9.25)
5.	**Kinnaur**	2350	75	25	362	120	70	451	3453	200	3653
		(9.93)	(0.76)	(1.23)	(10.99)	(2.76)	(1.67)	(2.18)	(5.08)	(1.69)	(4.58)
6.	**Kullu**	1563	634	71	132	773	615	1622	5290	1	5291
		(6.60)	(6.42)	(3.50)	(4.01)	(17.77)	(14.71)	(7.84)	(7.78)	(0.01)	(6.63)
7.	**Lahaul Spiti**	3965	6	2	16	20	45	110	4164	840	5004
		(16.75)	(0.06)	(0.10)	(0.49)	(0.46)	(1.08)	(0.53)	(6.13)	(7.10)	(6.27)
8.	**Mandi**	3660	747	242	373	935	580	3177	9714	1618	11332
		(15.46)	(7.57)	(11.94)	(11.32)	(21.50)	(13.88)	(15.35)	(14.29)	(13.67)	(14.20)
9.	**Shimla**	6364	535	256	678	1579	1516	1058	11986	6250	18236
		(26.88)	(5.42)	(12.63)	(20.58)	(36.31)	(36.27)	(5.11)	(17.63)	(52.80)	(22.85)
10.	**Sirmour**	1588	2106	247	400	210	190	2628	7369	1400	8769
		(6.71)	(21.34)	(12.19)	(12.14)	(4.83)	(4.55)	(12.70)	(10.84)	(11.83)	(10.99)
11.	**Solan**	1215	4292	907	488	69	136	1391	8498	208	8706
		(5.13)	(43.49)	(44.75)	(14.81)	(1.59)	(3.25)	(6.72)	(12.50)	(1.76)	(10.91)
12.	**Una**	64	110	36	50	60	102	1111	1533	710	2243
		(0.27)	(1.11)	(1.78)	(1.52)	(1.38)	(2.44)	(5.37)	(2.26)	(6.00)	(2.81)
	Total	**23672**	**9870**	**2027**	**3295**	**4349**	**4180**	**20695**	**67968**	**11838**	**79806**
		(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)	(100.00)

Source: Directorate of Agriculture, Himachal Pradesh

Note: Figures in parenthesis are the percentage to total area under each vegetable

declined by 9.74 per cent and the use of farm yard manure on organic farms reduced by 9.04 per cent. The PMI of 91.16 meant that the composite production method index had fallen 8.84 per cent as compared to conventional farms. This analysis indicates the extent of use of inputs reduced by half with respect to the increase in the yield of peas in comparison to conventional farms, which is highly favourable impact of organic farming on the yield of peas on organic farms.

Small farms: On small organic farms, the yield of peas on organic farms had increased by 12.83 per cent in comparison to conventional farms. The higher yield was further supplemented by the 8.43 per cent lower use of inputs, resulted highly favourale impact of organic farming on the yield of peas on organic farms.

Other farms: The yield of peas had increased by 7.81 per cent. This increase in yield was attainted despite of 13.02 per cent less use of inputs as compared to conventional farms. This depicts medium favourable impact of organic farming on the yield of peas on organic farms.

All farms: There was 14.45 per cent increase in the yield of peas on organic farms. However, there was 1.28 per cent higher use of seed on organic farms; the PMI was 8.87 per cent less on organic farms, meaning highly favourable impact on the yield of peas.

Therefore, it may be concluded that organic farming production method resulted in higher yield of peas on organic farms. Marginal organic farms had more favourable position than small and other size of farms. This has been achieved with simultaneous reduction in input use levels and hence cost of cultivation.

(A) Beans

Marginal farms: The yield of beans on organic farms increased by 7.42 per cent, but seed rate also increased on an average by 26.69 per cent. The human-labour hours required per hectare on organic farms had fallen by 15.01 per cent. The bullock labour required had slightly increased by 1.30 per cent. The use of farm yard manure on organic farms had fallen by 19.63 per cent. The PMI was 98.34, which indicated that the composite production method had slightly reduced by 1.66 per cent on organic farms. The main finding of this is that the extent of use of inputs such as human labour and FYM had fallen, but seed rate and bullock labour remained almost constant. Though the yield of beans had increased about 7 per cent, but the medium impact of organic farming on the yield was observed on organic farms.

Small farms: The seed rate and bullock labour requirement increased by 13.08 and 23.45 per cent, respectively, on organic farms as reflected by the relative seed rate and bullock labour indices of 113.08 and 123.45, respectively. But the requirement of human labour and FYM was reduced by 9.82 and 33.84 per cent, respectively. The PMI of 98.22 indicated the inputs use reduced by 1.78 per cent on organic farms. Though the extent of use of human labour and FYM had fallen, but seed rate and bullock labour requirements remained almost identical with conventional farms. The yield was reduced by 2.78 per cent on organic farms. The impact of organic farming production method on the yield of beans was not visible.

Other farms: The yield increased by 17.93 per cent. The seed rate and bullock labour use increased slightly by 4.80, and 2.63 per cent on organic farms. The use of human labour and FYM was reduced by 5.87 and 52.16 per cent, respectively. This led to 12.65 per cent lower PMI, meaning a highly favourable impact of organic farming on the yield of beans on organic farms.

All farms: There was 6.05 per cent increase in the yield on organic farms, but there was also 20.53 and 7.19 per cent, higher use of seed and bullock

labour, respectively. The requirement of human labour and FYM declined by12.57 and 27.23 per cent, respectively. The PMI slightly reduced by 3.02 per cent on organic farms. Though the yield of beans was slightly higher on organic farms, but the impact of organic farming on this remained almost medium. The analysis reveals a mixed picture with the use of two inputs declining and of other two increasing.

To sum up, the impact of organic farming on the yield of beans was medium on marginal and all farms, high on other farms and not visible on small size of farms. The use of human labour and FYM had significantly reduced on organic farms, but seed rate and bullock labour use had increased in comparison to conventional farms.

(B) Capsicum

Marginal farms: The yield of capsicum had reduced by 1.48 per cent, but the impact of organic farming was not favourable reflected by PMI of 93.16. There might be other reasons behind the meagre performance of yield of capsicum on organic farms, for instance the venerability of capsicum to diseases in rainy season is higher, and unavailability of perfect substitute of plant protection chemicals on organic farms make this crop susceptible to insecticide and pesticides attacks. The requirement of human labour and FYM had significantly reduced by 19.90 and 23.19 per cent, respectively on organic farms, but per hectare requirement of seed and bullock labour was 9.46 and 6.26 per cent higher.

Small farms: The yield of capsicum was slightly higher (by 0.21 per cent) on organic farms. The requirement of seed, human labour and FYM was reduced by 19.26, 1.71 and 13.74 per cent, respectively, on organic farms. PMI reduced only by 1.77 per cent. A very low impact of organic farming was there on the yield of capsicum of organic farms. It is apparent that organic farming methods have yet to prove their efficiency in this case.

Other farms: The yield of capsicum was 4.45 per cent lower than conventional farms, but the impact of organic farming production method on this was not favourable reflected by PMI of 99.87, which showed the reduction of just 0.13 per cent. Seed and human labour use was 17.34 and 0.6 per cent less, respectively on organic farms; however bullock labour and FYM was respectively, 16.10 and 1.31 per cent higher.

All farms: The impact of organic farming production method on the yield was almost negligible, which was reflected by PMI of 95.22. The yield was 1.50 per cent lower.

Therefore, it can be said that the impact of organic farming production method on the yield of capsicum on organic farms remained almost negligible.

(C) Tomato

Marginal farms: The yield of tomato increased by 5.82 per cent with a seed rate increasing by 54.37 per cent. The human-labour required on organic farms had fallen by 41.12 per cent. The bullock labour was also reduced by 10.25 per cent and use of farm yard manure reduced by 50.41 per cent. This analysis revealed that however the extent of use of inputs had fallen and a medium favourable impact of organic farming was there on the yield of tomato.

Small farms: The seed rate requirement increased by 19.11 per cent on organic farms. But the requirement of human labour, bullock labour and FYM had reduced by 38.96, 15.72, and 31.97 per cent, respectively. The composite production method index was 83.11. The yield of tomato was 3.63 per cent lower on organic farms, indicated not favourable impact of organic farming production method on the yield of tomato.

Other farms: The yield of tomato reduced by 18.65 per cent. Per hectare requirement of seed was almost equal on both type of farms as indicated by

Table 6
Impact of organic farming production method on vegetables productivity on organic farms

Farm Category	*Yield index*	*Seed rate index*	*Human labour index*	*Bullock labour index*	*FYM index*	*PMI@*	*(+) Increase or (–) reduction in inputs (%)*	*(+)Increase or (–) decrease in yield (%)*	*Impact of organic farming*
				Peas					
Marginal farms	116.48 (46.71)	109.34 (28.62)	74.07 (855.16)	90.26 (36.9)	90.96 (120.39)	91.16	(–) 8.84	(+) 16.48	High
Small farms	112.83 (47.08)	90.36 (29.17)	86.22 (865.83)	95.89 (35.00)	93.81 (115.00)	91.57	(–) 8.43	(+) 12.83	High
Other farms	107.81 (47.73)	83.80 (31.82)	81.01 (895.63)	94.77 (25.94)	88.35 (119.32)	86.98	(–) 13.02	(+) 7.81	Medium
All farms	114.45 (46.96)	101.28 (29.27)	77.44 (864.27)	94.45 (34.07)	91.33 (118.92)	91.13	(–) 8.87	(+) 14.45	High
				Beans					
Marginal farms	107.42 (99.64)	126.69 (24.29)	84.99 (508.50)	101.30 (19.88)	80.37 (142.14)	98.34	(–) 1.66	(+) 7.42	Medium
Small farms	97.22 (113.43)	113.08 (29.17)	90.18 (478.91)	123.45 (17.41)	66.16 (135.19)	98.22	(–) 1.78	(–) 2.78	Not visible
Other farms	117.93 (96.15)	104.80 (27.69)	94.13 (458.98)	102.63 (19.14)	47.84 (126.92)	87.35	(–) 12.65	(+) 17.93	High
All farms	106.05 (102.69)	120.53 (26.03)	87.43 (493.82)	107.19 (19.14)	72.77 (138.18)	96.98	(–) 3.02	(+) 6.05	Medium
				Capsicum					
Marginal farms	98.52 (137.50)	109.46 (137.04)	80.10 (926.54)	106.26 (19.75)	76.81 (157.25)	93.16	(–) 6.84	(–) 1.48	Not visible
Small farms	100.21 (141.07)	80.74 (182.14)	98.29 (754.55)	127.63 (17.14)	86.26 (103.57)	98.23	(–) 1.77	(+) 0.21	Low
Other farms	95.55 (142.93)	82.66 (173.91)	99.40 (705.43)	116.10 (14.40)	101.31 (102.72)	99.87	(–) 0.13	(–) 4.45	Not visible

contd. table 6

Farm Category	*Yield index*	*Seed rate index*	*Human labour index*	*Bullock labour index*	*FYM index*	*PMI@*	*(+) Increase or (–) reduction in inputs (%)*	*(+)Increase or (–) decrease in yield (%)*	*Impact of organic farming*
All farms	98.50 (138.96)	99.31 (151.32)	86.84 (861.47)	112.46 (18.50)	82.26 (138.85)	95.22	(–) 4.78	(–) 1.5	Not visible
				Tomato					
Marginal farms	105.82 (264.62)	154.37 (128.54)	58.88 (1377.49)	89.75 (29.01)	49.59 (162.74)	88.15	(–)11.85	(+) 5.82	Medium
Small farms	96.37 (284.03)	119.11 (128.47)	61.04 (1299.27)	84.28 (28.13)	68.03 (140.97)	83.11	(–)16.89	(–) 3.63	Not visible
Other farms	81.35 (301.79)	100.00 (125.00)	74.55 (983.71)	86.93 (21.43)	76.42 (114.29)	84.48	(–) 15.52	(–) 81.35	Not visible
All farms	101.01 (272.89)	140.31 (128.12)	61.04 (1316.63)	88.16 (27.97)	56.78 (152.70)	86.57	(–) 13.43	(+) 1.01	Low

Note: @ Relative Production Method Index

Figures in parenthesis are the mean unit values on respective conventional farms

seed rate index of 100.00. Requirements of human and bullock labour and FYM declined by 25.45, 13.07, and 23.58 per cent, respectively, on organic farms. This all had resulted into 15.52 per cent less PMI. The analysis depicts that impact of organic farming production method was not favourable for the yield of tomato on other organic farms.

All farms: The yield index of 101.01 revealed that there was 1.01 per cent increase in the yield of tomato on organic farms, but seed rate increased by 40.31 per cent. The requirements of human labour, bullock labour and FYM declined by 38.96, 11.84, and 43.22 per cent per hectare, respectively, on organic farms. The PMI was 86.57, depicted that the composite production method had reduced by 13.43 per cent on organic farms. Though the yield of tomato was slightly higher on organic farms, but it was almost insignificant as compare to the reduction in input use. Hence, the impact of organic farming production method remained very low in the yield of tomato.

To sum up, the impact of organic farming production method on the yield of tomato remained almost negligible on small and other organic farms. The yield of tomato was slightly higher on marginal and all farms, but the medium and low impact of organic farming was observed on marginal and all organic farms, respectively.

CONCLUSION

From the foregoing analysis it is observed that in Himachal Pradesh major proportion of increase in vegetables production comes from area augmentation rather than from improvements in productivity as should be. This call for efforts for productivity improvement and this can be the form of better farm management, including rational use of production resources, infusion of technology and improvement in the quality of resources etc. This also paves the way for adoption of organic methods of farming as a tested methodology for improvement in aggregate production and productivity of vegetables. Organic farming production method resulted into higher yield of peas on different size of organic farms. The impact of organic farming was high on marginal, small and all organic farms, whereas medium impact was observed on other size of organic farms. For beans, a mixed picture of high, medium and negligible impact of organic farming on the yield was found. In capsicum the impact of organic farming production method was quit negligible on organic farms. In the yield of tomato medium benefits of organic farming was found on marginal organic farms, whereas there was negligible impact of organic farming on the yield of tomato on small and other organic farms. Overall, very low positive impact of organic farming on the yield of tomato was observed on all organic farms. Therefore, the analysis reveals that the productivity of peas were benefited highly from organic farming production methods, while beans got medium impact, tomato had low impact and capsicum got negligible response. There is much need to be done for effective working of organic farming production method for improvement in vegetables production and productivity in the State.

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