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Comparative analysis of production and profitability of seasonal vegetable, tuber and spice crops under the mid-hills of Meghalaya

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Abstract

A field experiment was conducted during 2011–2013 at Horticulture Experiment Farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya to identify the economical vegetable crop and cropping system for improving profitability of the farmers. The high yielding varieties of 15 warm season and 13 cool season crops including tuber and spices were evaluated. Among the warm season crops, tomato was found highly profitable with net income of Rs 467500/ha and input–output ratio of 6.45 followed by brinjal and bottle gourd. Similarly, in cool season crops, the highest yield per hectare was recorded from cabbage. However, the highest input–output ratio was from dolichos bean followed by cabbage and broccoli. Tomato–cabbage cropping system was found to be most economical with Rs 745000 (net income) and 5.75 (input–output ratio) followed by brinjal–cabbage (solanaceous–crucifer vegetable based cropping system). Under legume–cucurbits systems, dolichos bean–bottle gourd and dolichos bean–cucumber cropping systems were highly profitable with higher net income and input–output ratio. The resource rich farmers can get the higher income from the production of tomato/brinjal–cabbage/broccoli cropping system and resource poor farmers can get higher income with dolichos bean/French bean–bottle gourd/cucumber cropping systems with least investment. Further, farmers can increase their income by improving cropping intensity (CI) up to 200% over the existing 100% from rice/ginger/turmeric/maize based mono-cropping.

Keywords: Vegetable, vegetable based cropping system, yield, economics, input-output ratio

Introduction

Under horticulture sector, vegetable, tuber and spice crops are prime sources of livelihood and nutritional security for the people of the NEH Region of India. A wide range of crops are grown due to diverse agro–climate of the region. Rapid increases in population, higher income and greater awareness amongst consumers and producers to diversify their food basket and production systems have increased the demand for vegetables. Vegetables are the only source to increase not only the nutritive value of food but also its palpability at very cheap rate. There are five major nutrients namely carbohydrates, proteins, fats, minerals and vitamins. The first three are required in large quantities and all of them supply energy to keep the body moving. Although, region is surplus in vegetable production and per capita availability of vegetables in Meghalaya is 421.2 g/day (Rao 2013) which is over to recommended dietary allowances (RDAs) of the Indian Council of Medical Research (ICMR). However, the micronutrient deficiency especially of calcium, iron and carotene is very common in children (Agrahar 2005). Moreover, vegetables are grown commercially in some pockets of the region and sold to the consumers at higher price in the markets due to high transportation cost. Unlike other areas, ginger and turmeric are the main cash crop because of low perishability and less management problems in niche production sites. However, now cultivation of vegetables to large extent improves the nutritional security of the local population. The area and production under vegetables including tuber and spices is 61100 ha and 599200 mt, respectively. The productivity of the crop is very low i.e. 11.8 and 4.8 t/ha of vegetables and spices, respectively (NHB 2015). The low productivity of the crop is mainly due to poor crop management, non–availability of the quality seeds and planting materials, and problems of abiotic (moisture stress) and biotic (pest and diseases) stresses.

Meghalaya experiences two distinct seasons, i.e. winter and monsoon, and is characterized by a cool climate throughout the year. NEH Regions, including Meghalaya, is known for the integrated farming system, the vegetable

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crops are grown in backyard and *Jhum* lands (Singh *et al.* 2013). The soil under *Jhum* systems is highly fragile and getting eroded by heavy rains during the rainy season and also losses the nutrient by leaching and fixation. Mixed cropping is a common feature under *Jhum*/ shifting cultivation (Kushwaha and Ramakrishnan 1987) and under mid–hills over 13 crops are grown in mixed (Toky and Ramakrishnan 1981). To improve the production system, there is also need to identify suitable cropping system which gives higher yield without impairing soil fertility. Very little work has been done on the yield and economic aspects, and suitable cropping system in the region, especially in vegetable crops. The researchers have worked on the production and profitability in few vegetable crops (Akter *et al*. 2011, Baruwa *et al*. 2013, Sarma *et al*. 2014 and Singh *et al*. 2016).

To increase the income of the farmers, this investigation was under taken to study the production potential of important seasonal vegetables including tuber and spices. The comparative profitability of the crops and vegetable based cropping system was accordingly studied.

Materials and Methods

This experiment was carried out for two consecutive years (2011–2013) at Horticulture Experimental Farm, ICAR Research Complex for NEH Region, Umiam, Meghalaya. The experimental soil was sandy in texture with acidic reaction (pH: 5.36). The bulk density, soil organic carbon, available N, P, K, Ca and Mg were 1.46 g/cc, 2.10%, 180 kg/ha, 18.16 kg/ha, 280 kg/ha, 2.23 meq/100g and 0.64 meq/100g, respectively. Total 15 warm season and 13 cool season crops were grown under vegetable based cropping system in the plots of size 2.5 m x 2.0 m (Table 1). The standard packages of practices were followed for all the crops. The superior varieties/ lines were selected based on the performance in the previous experiments. The varieties were evaluated in Randomized Block Design (RBD) with three replications. The observation was taken for yield per plot (kg) and estimated the yield (t/ha). The price of the produce was calculated based on current wholesale price. The total cost of production was estimated including input cost, labour charges, interest on capital and other expenditures.

Results and Discussion

Production potential and economics of the warm season crops: The wider variation was observed for yield in different crops (Table 2). Among the warm season vegetable crops, the highest yield (49.60 ± 5.09 t/ha) was recorded in tomato and lowest (6.13 ± 0.18 t/ ha) was in okra. Among the solanaceous crops, the highest production was in tomato followed by brinjal, capsicum and chilli. Under legume vegetables the highest yield was recorded from French bean pole type (10.0 ± 1.41 t/ha) followed by French bean (bush type). Similarly, highest yield was recorded from bottle gourd in cucurbits, colocasia in tubers and turmeric in spices. The results on economic analysis have also shown the wider variation in net income and input–output ratio (Table 2). Among the crops, the highest net income per hectare was recorded from the crop tomato (Rs 467500) followed by brinjal and bottle gourd. However, from the input–output analysis, the highest output was recorded from bottle gourd with input–output ratio of 6.83 followed by tomato (6.45), cucumber (6.24), brinjal (5.56) and pole type French bean (5.22).

Production potential and economics of the cool season crops: The wider variation was also observed for yield in different cool season crops (Table 3). Among the cool season vegetable crops, the highest yield (46.40

Table 1. Seasonal crops and their growing period under mid–hills of Meghalaya

Warm season vegetable crops			Cool season vegetable crops		
Crop	Variety	Crop Period	Crop	Variety	Crop Period
Brinjal	Arka Nidhi	February–October	Cauliflower	Pusa Meghna	September–January
Tomato	Megha Tomato–3	January–May	Cabbage	H–139 F_1	September–January
Capsicum	California Wonder	January–May	Broccoli	Pushpa F_1	September–January
Chilli	Kashi Anmol	February–October	Knol-khol	White Vienna	September–January
Okra	VRO–6 (Kashi Kranti)	March–August	Carrot	New Kuroda	September–January
Cucumber	Long Green	March–July	Radish	Local White	September–January
Bottle gourd	Local	March–August	Onion	Bhima Super	September–January
Amaranthus	Pusa Lal Chaulai	July–September	Coriander	Pant Haritima	September–January
French bean	Arka Suvidha	July–October	Mustard green	Megha Laipatta–1	September–January
French bean (pole)	Naga Local	July–September	Lettuce	Ice berg	September–January
Cowpea	Local (Pole type)	July–October	Dolichos bean	Local	July–March
Colocasia	Muktakesi	March–October	Pea	Azad Pea-1	October–January
Sweet potato	Local	March–October			
Ginger	Nadia	March–November			
Turmeric	Megha Turmeric–1	March–November			

Table 2. Production potential and profitability of warm season crops

S. No.	Crop	Yield (kg/plot)	SD	Yield (t/ha)	SD	Rate (Rs/kg)	Gross Return (Rs)	Cost of Production (Rs)	Net Income (Rs)	Input: Output ratio
1	Brinjal	15.85	2.47	31.70	4.95	15.0	475500	72500	403000	5.56
2	Tomato	20.50	3.54	49.60	5.09	15.0	540000	72500	467500	6.45
3	Capsicum	5.00	0.28	9.52	1.24	30.0	285600	72500	213100	2.94
4	Chilli	4.75	0.07	9.50	0.14	30.0	285000	75500	209500	2.77
5	Okra	3.07	0.09	6.13	0.18	30.0	183900	46000	137900	3.00
6	French bean	4.33	0.25	7.65	0.49	25.0	191250	35000	156250	4.46
7	French bean (pole)	6.35	1.20	10.00	1.41	25.0	250000	40195	209805	5.22
8	Cow pea	3.65	0.21	7.75	0.35	25.0	164250	40000	124250	3.11
9	Amaranthus	4.95	1.48	9.15	1.91	15.0	137250	31500	105750	3.36
10	Cucumber	15.20	2.26	30.40	4.53	10.0	304000	42000	262000	6.24
11	Bottle gourd	30.00	2.83	36.00	2.83	10.0	360000	46000	314000	6.83
12	Colocasia	11.00	0.71	19.80	1.27	15.0	297000	68000	229000	3.37
13	Sweet Potato	6.20	0.28	12.40	0.57	12.0	148800	31500	117300	3.72
14	Ginger	7.90	1.27	16.60	1.41	20.0	332000	94355	237645	2.52
15	Turmeric	13.00	1.41	25.00	4.24	15.0	375000	78022	296978	3.81

SD: Standard deviation

Table 3. Production potential and profitability of cool season crops

S. No.	Crop	Yield (kg/plot)	SD	Yield (t/ha)	SD	Rate (Rs/kg)	Gross Return (Rs)	Cost of Production (Rs)	Net Income (Rs)	Input: Output ratio
1	Cauliflower	12.00	1.41	21.60	2.55	15.0	324000	57000	267000	4.68
2	Cabbage	27.70	4.67	46.40	3.39	10.0	464000	57000	407000	7.14
3	Broccoli	8.05	1.06	15.22	0.88	25.0	380500	55000	325500	5.92
4	Knol–khol	7.25	0.07	14.80	0.28	15.0	219000	57000	162000	2.84
5	Pea	3.65	0.21	7.30	0.42	25.0	182500	36000	146500	4.07
6	Dolichos bean	8.94	0.37	13.15	1.20	30.0	394500	45195	349305	7.73
7	Carrot	4.85	0.21	9.80	0.28	20.0	196000	36000	160000	4.44
8	Radish	7.50	0.71	15.00	1.41	10.0	150000	23000	127000	5.52
10	Onion	8.00	2.83	16.00	5.66	15.0	240000	55000	185000	3.36
11	Coriander	2.45	0.49	4.65	0.99	25.0	116375	38000	78375	2.06
12	Mustard green	7.50	0.71	15.00	1.41	10.0	150000	33000	117000	3.55
13	Lettuce	3.88	0.53	7.75	1.06	25.0	193750	38000	155750	4.10

SD: Standard deviation

± 3.39 t/ha) was recorded in cabbage and lowest (4.65 ± 0.99 t/ha) in coriander. Among the cole crops, the highest production was in cabbage followed by cauliflower, broccoli and knol–khol. Similarly, the highest yield was recorded from radish in root vegetables and mustard green in leafy vegetables. The comparative analysis of result on net income (Table 3) reveals that the highest income (Rs 407000) was recorded from the cabbage followed by dolichos bean and broccoli. Likewise, the highest output per unit input was recorded from Dolichos bean (7.73) followed by cabbage, broccoli and radish. The lowest income (Rs 117000) and input–output ratio of 2.02 and 2.84 was recorded from mustard green and knol–khol, respectively.

From cropping system analysis, it was observed that tomato–cabbage cropping system was most economical with net income of Rs 745000/ha and input-output ratio of 5.75 followed by brinjal–cabbage cropping system with net income of Rs 680500/ha hectare and input–output ratio of 5.25 under solanaceous–crucifer vegetable based cropping system. Under legume–cucucurbit systems, dolichos bean–bottle gourd (Rs 572110/ha and 6.27) and dolichos bean–cucumber (Rs 524110/ha and 6.01) cropping systems were highly economical with higher net income and input–output ratio, respectively. The highest net return has also been reported from tomato followed by brinjal and cabbage by Singh *et al*. (2016). The dolichos bean–bottle gourd of legume–cucurbits cropping system could be adopted especially in mid-hills as they are potential in protecting soil from erosion, improving soil fertility and also tolerant to moisture stress and suitable for the rainfed production. In foot hills, tomato/brinjal–cabbage/broccoli can be grown with assured irrigation facility.

The above findings have indicated the potential of increasing the farmers' income by prioritizing of the potential crops such as tomato, brinjal, cucumber and bottle gourd of warm season, and cabbage, broccoli and dolichos bean of cool season. Further, through rain water harvesting and proper soil moisture conservation

measures, cropping intensity can be increased up to 200% which can double the income by vegetable based cropping system over the existing mono-cropping practices with ginger, turmeric, rice and maize. Inclusion of vegetables in the cropping system will not only increase the availability at affordable price and checking the market volatility, but also improve the soil fertility especially through legume based cropping system. With commercial production of highly remunerative crops, farmers can grow the crops/ improved varieties in backyards for nutritional security. The micronutrient deficiencies in the population can be combatted by food based approaches including homestead garden, dairy, poultry, fish farms, etc through agriculture diversification (Sharma 2005). Some common iron, folic acid and carotene rich vegetables like spinach, coriander and carrot should be encouraged for regular consumption to ensure nutritional well being. Also they fit well into different cropping system short duration of cropping.

सारांश

किसानों की मुनाफे में सुधार हेतु किफायती सब्जी की फसल और फसल पद्धति की पहचान के लिए यह प्रयोग बागवानी प्रयोग फार्म, भारतीय कृषि अनुसंधान परिषद, पूर्वोत्तर पहाड़ी क्षेत्र, अनुसंधान परिसर, उमियम, मेघालय में वर्ष 2011/2013 के दौरान किया गया। इस प्रयोग में गर्म मौसम की 15 और ठंडी मौसम की 13 फसलों की उच्च पैदावार वाली किस्मों का मूल्यांकन किया गया। गर्म मौसम की फसलों में टमाटर की खेती से शुद्ध लाभ रु 467500 प्रति हेक्टेयर और निवेश–आय अनुपात 6.45 के साथ बेहद लाभदायक पाया गया, इसके बाद बैंगन और लौकी उपज और आर्थिक दृष्टि से देखने के मामले में बेहतर पाया गया। इसी तरह, ठंडे मौसम की फसलों में, प्रति हेक्टेयर में सबसे अधिक उपज पत्तागोभी से दर्ज किया गया। हालांकि, उच्चतर निवेश–आय अनुपात सेम से था, जिसके बाद फूलगोभी और ब्रोकोली में देखा गया। टमाटर–गोभी फसल प्रणाली से रु 745000 (शुद्ध आय) और 5.75 (निवेश–आय अनुपात) के साथ सबसे अधिक किफायती पाया गया, इसके बाद बैंगन–गोभी (सोलनेसियस–क्रूसिफर सब्जी आधारित फसल प्रणाली), जबकि दलहन–कद्दू फसल प्रणाली के तहत, सेम–लौकी और सेम–खीरा की फसल प्रणालियों से उच्च शुद्ध आय और निवेश–आय अनुपात के साथ अत्यधिक लाभदायक पाया गया। संशाधन संपन्न किसान टमाटर/बैंगन–गोभी/ब्रोकोली फसल पद्धति के उत्पादन से उच्च आय प्राप्त कर सकते हैं और गरीब किसान सेम/फ्रेंचबीन–लौकी/खीरा फसल पद्धति से कम निवेश के साथ उच्च आय प्राप्त कर सकते हैं। इसके अलावा, चावल/अदरक/हल्दी/मक्का आधारित एकल फसली प्रणाली से मौजूदा 100% से 200% फसल की गहनता करके किसान अपनी आमदनी को दोगुना बढ़ा सकते हैं।

References

Agrahar MD (2005) Nutritional status of Khasi schoolgirls in Meghalaya. Nutrition 21(4):425-31.

Akter S, Islam MS, Rahman M S (2011) An economic analysis of winter vegetables production in some selected areas of Narsingdi district. Department of Agricultural Economics, Bangladesh Agricultural University, 9(2): 241–246.

Baruwa OI and Adesina CA (2013) Economics of Leafy Vegetable Production. Int J Veg Sci 19(1):21-25.

Kushwaha SPS, Ramakrishnan PS (1987) An analysis of some agro ecosystem types of north eastern India. Proc Indian Natn Sci Acad B 53(2):161–168.

NHB (2015) Indian Horticulture Data Base (2014–15). National Horticulture Board, Ministry of Agriculture, Government of India 85, Gurgaon–122 015, India pp. 286

Rao BSN (2013) Fruits, vegetables, milk and animal foods in balanced Indian diets– a critical appraisal. NFI Bulletin 34(1) 1–5.

Samra, NS and Kataria P (2014) Profitability analysis of vegetable growers vis–à–vis farm size in Punjab. J Agri Sci 5(1–2): 11–17.

Sharma V (2005) Technologies for empowering women. A compendium produced on the occasion of the International Conference – Impact of women's research in science and technology in the new millennium 21–25 November 2005, Bangalore, pp 82.

Singh BK, Ramakrishna Y, Verma VK and Singh SB (2013) Vegetable cultivation in Mizoram: status, issues and sustainable approaches. Indian J Hill Farming 26 (1): 1-7.

Singh HL, Sharma A and Kumar T (2016) Economic analysis of vegetable production in Meerut district of Uttar Pradesh. Int J Trop Agric 34(3):727–731.

Toky OP and Ramakrishnan PS (1981) Cropping and yield in agricultural system of North eastern hill region of India. Agro–Ecosystems 7:11–25.