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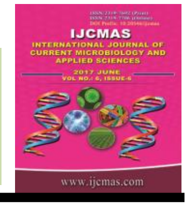

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Productivity, Profitability and Economic Viability of a Diversified Farm in Faridkot District of Punjab, India

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A B S T R A C T

Rice-wheat is a major cropping system prominent on 2.5 million hectares in Punjab. Irrigation is commonly used to stabilize the productivity of this system using surface canal and sub-soil tube well water. Judicious use of water and land resources has been a major challenge for agriculture and it is imperative to use these scarce resources efficiently. This paper describes various alternative cropping systems being adopted by a progressive farmer to attain the goal of raising productivity and meeting food security needs along with efficient use of natural resources including water, providing environmental benefits and improving the rural livelihood of farmers. The results of investigations reveal that vegetable based cropping systems and horticultural crops gave higher rice equivalent yield as compared to rice-wheat cropping system. The data on economic viability and profitability of various cropping systems indicated the highest net returns under rainy season bottle gourd-summer squash cropping system (Rs 6,06,075/ha), which was followed by rainy season bottle gourd-capsicum and rainy season bottle gourd-tomato cropping system. Rice-wheat recoded the lowest net returns (Rs.1, 29,963/ha). The B: C ratio of different cropping systems varied from 2.87 to 4.84 and predominant rice-wheat cropping system showed B: C of 3.24. It may be concluded that the vegetable and horticultural based cropping systems are biologically efficient and highly profitable, however; Punjab farmers' still prefer rice-wheat sequence due to their better stability and assured marketing.

Introduction

During the 1950s and early 1960s, South Asia suffered frequent and severe food shortages. Beginning in the late 1960s, however, production of rice and wheat increased dramatically throughout the region due to 'Green Revolution,' spurred by new high yielding dwarf wheat and rice varieties, a favorable resource base, rapid expansion of fertilization and irrigation facilities and an extremely supportive policy environment. The Green revolution greatly reduced the incidence of hunger and starvation through rapid growth in agricultural production, particularly in India's rice-wheat cropping systems.

Presently, rice-wheat system provides the staple grain supply for about 8% of the world's population, making this system critically important for global food security (Ladha *et al.*, 2003, Timsina and Connor 2001). In Punjab, rice-wheat is the most predominant cropping system adopted on an area of 2.53 m ha.

Its cultivation has been extended to the non-conventional area because of its better adaptation, favorable government policies and free electricity for tube wells. Farmers are getting productivity from rice based cropping systems at the cost of over exploitation of natural resources. Continuous rice-wheat cultivation has led to the buildup of pests and diseases and has also led to land degradation as continuous puddling destroys the soil structure that takes long time to come into normal condition. The ecological intensification of agricultural systems is aimed at satisfying the anticipated increase in demand for agricultural products while meeting acceptable standards of environmental quality (Cassman 1999). Higher productivity with sustainability remains the major concern of any crop planning. Any cropping system which requires less input but has higher productivity is considered to be the efficient. Hence, in view of concerns regarding degradation of natural resources and new policies of open economy, there is a dire need for diversification of farming by shifting considerable area towards other crops/ cropping system like vegetables and fruit crops.

Punjab is a tiny state of India having geographical area of 50 lac ha, out of which 48.6 lac ha is cultivable land. However, the situation is more alarming due to the fact that more than 28.9 lac ha is under paddy cultivation and a sizable area of only 2.80 lac ha is under orchard and vegetable crops (Anonymous 2014, 2015). Majority of the farmers are engaged in rice- wheat cropping system with some exceptions. One such exception is S. Amarjit Singh Dhillon from village Bargari, District Faridkot, Punjab. His farm is a picture- perfect highly diversified farm that boosts of variety of crops including wheat, paddy and some horticultural and vegetable crops. Adoption of horticultural and vegetable crops besides giving higher income has the added advantage of limited water requirement and potential of employment generations throughout the year. In this study, we have made an attempt to evaluate the performance of different cropping systems using various indicators of system efficiency.

Materials and Methods

The present studies were undertaken at the diversified farm of S. Amarjit Singh Dhillon from village Bargari, district Faridkot, situated at 30°31' N latitude and 74°55' E longitude with a height of 210 meter above the mean sea level in South-western arid zone of Punjab. Out of an operational land holding of 10.0 hectares, 50 % of the area is under horticultural crops. He has installed drip irrigation system throughout his farm and harnesses the benefits of solar energy to uplift water from storage tank. He raises rainy season bottle gourd under bower and summer season bottle gourd, summer squash, tomato and capsicum under low tunnel. The sowing and harvesting of various crop grown by him is depicted in table 1.

A questionnaire was prepared to gather information regarding the yield and gross returns of different crops as well as income and expenditure incurred thereof at the farm of Amarjit Singh Dhillon. For valid comparison of different cropping systems, the yield of crops was converted into rice equivalent yield by considering the price of produce. System productivity (yield per unit area per unit time) was calculated by dividing rice equivalent yield by 365. Relative production efficiency (RPE) of different cropping systems in relation to the predominant (rice-wheat) cropping system was calculated as under:

RPE(%) = EYD-EYE x 100/EYE where EYE denotes rice equivalent yield under predominant (rice-wheat cropping system) and EYD denotes rice equivalent yield under diversified cropping systems. Net returns per ha were calculated by subtracting cost of cultivation (as per budget ledger of farmer) from gross returns of a particular crop in cropping system. The benefit cost ratio (B: C ratio) for different cropping systems was calculated by dividing the gross returns by cost of cultivation in the system.

Results and Discussion

The data in table 2 revealed that all the alternative cropping systems/ crops out yielded rice-wheat cropping system. It is further evident that vegetable based cropping system (rainy season bottle gourd trained on bower system-capsicum/tomato/summer squash) gave 503.9, 456.2 and 552.8 q/ha/annum rice equivalent yield, respectively, against 129.5 q/ha/annum in rice-wheat cropping system. Likewise, summer season bottle gourd as intercrop in newly planted kinnow orchard, sole crop of guava, grapes and kinnow (14 years each) also resulted in higher rice equivalent yield of 162.9, 318.6, 233.7 and 306.2 q /ha/annum, respectively. The higher rice equivalent yield in horticultural crops/ cropping pattern can be ascribed to the higher yield of horticultural crops. Similar trend was also observed for system productivity. Gangwar *et al.,* (2006) also reported higher system productivity under horticultural crops. The data on relative production efficiency (RPE) of various cropping systems in comparison to pre-dominant rice-wheat cropping system also indicated the highest values under rainy season bottle gourd-capsicum/tomato/summer squash cropping system, which recorded the relative production efficiency of 289.1, 252.3 and 326.9 % respectively. Similarly, summer season bottle gourd as intercrop in newly planted kinnow orchard, sole crop of guava, grapes and kinnow (14 years each) also resulted in higher RPE.

Table.1 Sowing and harvesting period of different crops and area under different crops

S. No.	Crop/fruit/vegetable	Sowing/ transplanting time	Crop over by	Area (ha)
1	Guava	Perennial crops		0.8
2	Grapes			0.6
3	Kinnow			1.8
3	Bottle gourd (under bower)	Rainy season crop : Last week of May to 1st week of June	2nd week of November	1.2
	Bottle gourd	Summer season crop : Last week of November	2nd fortnight of May	0.8
4	Capsicum	2nd fortnight of November	Last week of May	0.2
5	Tomato	1st week of December	Last week of May	0.2
6	Summer squash	Last week of November	First week of April	0.8
7	Paddy	15th to 20th June	1st fortnight of October	4.8
8	Wheat	1st fortnight of November	2nd fortnight of April	4.8

Table.2 Yield of crops in system and indicators of system efficiency under various cropping systems

Crops/ cropping system	Yield (q/ha)		Rice equivalent yield (q/ha)	System Productivity (Kg/ha/day)	Relative Production Efficiency (%)
	1	2			
Rice-Wheat	76.25	50.75	129.5	35.5	-
Rainy season bottle gourd trained on bower system-capsicum	318.75	252.50	503.9	138.1	289.1
Rainy season bottle gourd trained on bower system-Tomato	312.5	321.30	456.2	125.0	252.3
Rainy season bottle gourd trained on bower system-summer squash	317.5	250.25	552.8	151.5	326.9
Summer season bottle gourd as intercrop in newly planted kinnow orchard	337.5	-	162.9	44.64	25.8
Guava (Age 14 yr)	385		318.6	87.3	146.0
Grape (Age 8 yr)	242		233.7	64.03	80.5
Kinnow (Age 8 yr)	444		306.2	83.9	136.4

Table.3 Profitability and economic viability of various crops/ cropping systems

Cropping system	Gross Returns (Rs/ha)	Variable Cost (Rs/ha)	Net returns (Rs/ha)	Profitability (Rs/ha/day)	B:C ratio
Rice-Wheat	1,87,956	57,993	1,29,963	356	3.24
Rainy season bottle gourd trained on bower system-capsicum	7,30,625	1,97,750	5,32,875	1460	3.69
Rainy season bottle gourd trained on bower system-Tomato	6,61,530	1,91,750	4,69,780	1287	3.45
Rainy season bottle gourd trained on bower system-summer squash	8,01,575	1,95,500	6,06,075	1660	4.10
Summer season bottle gourd as intercrop in newly planted kinnow orchard	2,36,250	70,500	1,65,750	454	3.35
Guava (Age 14 yr)	4,62,000	95,500	3,66,500	1004	4.84
Grape (Age 8 yr)	3,38,800	1,18,000	2,20,800	605	2.87
Kinnow (Age 8 yr)	4,44,000	1,13,750	3,30,250	905	3.90

The data on economic viability and profitability of various cropping systems indicated the highest net returns per ha under rainy season bottle gourd-summer squash cropping system (Rs 6, 06,075/ha) followed by rainy season bottle gourd-capsicum and rainy season bottle gourd-tomato cropping system. Rice-wheat recorded the lowest net returns (Rs. 1, 29,963/ha) and profitability (Rs 356/ha/day). The B: C ratio of different cropping systems varied from 2.87 to 4.84 and predominant rice-wheat cropping system recorded B:C ratio of 3.24 (Table 3). Dhillon *et al.*, (2012) also reported higher profitability of cropping systems alternative to rice-wheat. It may be concluded that the vegetable and horticultural crops are biologically efficient, highly profitable crop sequences, however; the Punjab farmers' still prefer rice-wheat sequence due to their better stability and assured marketing.

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