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Comparative Evaluation of Different Production Systems in Western Himalayan Regions

Purushottam Dev, S.S. Paliyal, Navjot Rana, Praveen Thakur, Prabhat Ranjan, Disha Patial

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ABSTRACT

Field experiment were conducted at the research farm of the CSK HPKV Palampur, Hill agriculture research and extension center (HAREC), Dhualakuan (HP) during *kharif* 2020 on sandy loam soil to study the comparative evaluation of different production systems in western Himalayan regions. The experiment was laid out under split plot design with three replications comprising of five crops i.e., Maize, Okra, Sesame, Black gram and rice under different management practices i.e., Organic, SPNF, conventional management practices. Highest maize grain equivalent yield (5228 kg ha^{-1}) and production efficiency (14.32 kg ha^{-1} day^{-1}) was recorded under okra crop and lowest under black gram crop and under management practices conventional management practices was superior over others. Okra crop in combination with conventional management practices recorded highest gross returns (Rs ha^{-1} 1,21903), net returns (Rs ha^{-1} 88,406) and net returns per rupee invested (Rs ha^{-1} 2.64).

Keywords Economics, Management practices, Productivity, Profitability, Production efficiency.

INTRODUCTION

Agriculture is an important component of India's economy. Agrarian distress is exacerbated by a low level of absolute income and disparity between farm and non-farm workers. Farmers' suicides increased dramatically in the country from 1995 to 2004 as a result of losses from farming, price shock, and low income, among other factors. This period also coincides with slowdown in growth rate of agricultural output there was need of doubling the farmers income. Farmer's income has always remained low as compared to non-farm workers. The disparity was quite large and it need a policy to accelerate pace. Past trend related to farmers income are very unclear. Green revolution has been a mixed bag for Indian agriculture. The prime example being the state of Punjab and Haryana where the focal point of the revolution suffered the most. The injudicious and imbalanced application of agrochemical has led to several ill effect on human on produce. Saline soil, depleted groundwater, imbal-

Purushottam Dev[1], S.S. Paliyal[2],Praveen Thakur[3],Disha Patial[4]
[1,2,3,4]Deptt of Soil Science, CSK HPKV Palampur, HP, India

Navjot Rana*
Deptt of Agronomy, CSK HPKV Palampur 176061, HP, India

Prabhat Ranjan
Deptt of Agronomy, RPCAU, Pusa, Samastipur, Bihar, India

Email: navjotrana7@gmail.com
*Corresponding author

anced NPK dose in soil and several environmental implications are widely overseen. The input intensive agriculture lured farmers of taking non-institutional loans but the low productivity, monsoon dependence, low minimum support price, market upsets trapped farmers in infinite loop of debts.

In a survey of NABARD 2018, In India all agricultural households were in a debt of more than Rs one lakh. When NABARD revealed the results of its, it offered the nation a gift, revealing that 87% of families were small and marginal farmers. Changes in weather, minimum support price (MSP), demand-supply gap, and natural calamities have all been linked to annual variations in agricultural production. India has certainly grown from its days of hunger to exporting food commodities of worth about 11.72 billion US dollars (DGCIS 2019-20), but after the green revolution India has heavily depended on import of fertilizers worth 2,098.61 million US Dollars in year 2014-15 (Department of fertilizers 2014-15), pesticide and several other chemicals for conventional farming. The injudicious use of chemicals in soil has damaged the fertility by degrading its physical, chemical and biological aspects damaging native soil flora, loss in population of honeybees and several other agriculturally beneficial insects, polluting water and atmosphere compelled the policies makers and scientists to steer their strategies towards organic farming. Conventional production system being easily available quicker results yielded higher benefit to cost ratios, gross and net returns, and a lower total cost of production, indicating that organic farm management require grater manpower, higher cost of cultivation and need a specialized market and consumers. Agriculture employs more than 50% of the population but its contribution of the national GDP (gross domestic product) is comparatively very low.

MATERIALS AND METHODS

Field experiments were conducted at the research farm of the CSK HPKV Palampur, Hill agriculture research and extension center (HAREC), Dhualakuan, HP, India (30° 6N and 71° 5E) latitude at an altitude of 468 m above mean sea level in *kharif* 2020. The experimental site is located in a sub-montane region with rainfall of 246 mm during the crop season. The soil is classified as Typic Ustipsamments with sandy loam texture, slightly acidic pH (6.24). The soil is characterized by low organic carbon (6.00 g kg^{-1}), available N (325 kg ha^{-1}) and available P (21 kg ha^{-1}), high in available K (148 kg ha^{-1}). They were sown in split plot design and replicated thrice, under main plots five crops were raised namely maize (*Zea mays* L.), Okra (*Abelmoschus esculentus*), Sesame (*Sesame indicum* L.), black gram (*Vigna mungo*) and rice (*Oryza sativa*). Under sub plots three management practices were raised i.e., organic, SPNF and conventional management practices. In organic system FYM and vermicompost (50:50) were applied along with vermiwash spray at 30 days interval. In Subhas Palekar natural farming system Beejamrit was applied to seed and seedlings and *jeevamrit* was sprayed at 30 days interval along with straw mulch. In conventional system IFFCO grade 12:32:16 NPK fertilizer along with murate of potash (MOP) and urea were applied at recommended dose. No serious incidence of insects or diseases was observed. No premium pricing of organic and natural farming products was taken as the experimental plot was not certified. For comparative performance, yields of different crops was converted into maize grain equivalent yield (MGEY). Profitability of different crops was worked out by sum of all the expenditures from land preparation to harvesting was summed up in cost of cultivation and gross returns was the total profit earned after raising the crops. Net returns were summed up by subtracting gross returns to cost of cultivation and net returns per rupee invested was worked out by dividing net returns with cost of cultivation. The data was analyzed as per described by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Maize grain equivalent yield

Maize grain equivalent yield was highest under okra (5228 kg ha^{-1}) in terms of crops which was followed by maize and rice crop and lowest under black gram crop (2905 kg ha^{-1}). This may be due to high yielding ability of okra crop among all other crop. Inclusions of vegetables by replacing cereal crops gives more yield (Stagnari *et al*. 2017). Under management practices,

highest maize grain equivalent yield was recorded under conventional farming practices which was followed by organic and SPNF management practices.

Production efficiency

Production efficiency was highest under okra (14.32 kg ha^{-1} day^{-1}) in terms of crops which was followed by maize and rice crop and lowest under black gram (7.96 kg ha^{-1} day^{-1}). In terms of management practices, production efficiency was highest under conventional farming practices which was followed by organic and SPNF management practices. Low production efficiency could be due to high labor demanding nature of organic and SPNF farming practices (Kees 2000) (Table 1).

Cost of cultivation

Highest cost of cultivation was recorded under okra crop in combination with organic management practices (Rs 1,05920) which was followed by black gram in combination with organic management practices (Rs 76120). This may be due to high cost of vermicompost and more labor-intensive nature of organic inputs (Lampkin 1996, Chiappe and Flora 1998, Kumar *et al*. 2017, Das *et al*. 2020). Lowest cost of cultivation was recorded under sesame in combination with SPNF (Rs 26718) (Table 2).

Table 1. Effect of treatments on maize equivalent yield and production efficiency.

Treatments	Maize equivalent yield (kg ha^{-1})	Production efficiency . (kg ha^{-1} day^{-1})
	Crops	
Maize	3756	10.29
Okra	5228	14.32
Sesame	2964	8.12
Black gram	2905	7.96
Rice	3297	9.03
SEm (±)	47	0.10
LSD (P=0.005)	154	0.32
	Management practices	
Organic	3518	9.64
SPNF	3265	8.95
Conventional	4105	11.25
SEm (±)	40	0.08
LSD (P=0.005)	119	0.21

Table 2. Effect of treatments on cost of cultivation and gross returns.

Treatment	Cost of cultivation (Rs ha^{-1})		Gross returns (Rs ha^{-1})
Crops	Management practices	*kharif* 2020	
Maize	Organic	63720	84772
	SPNF	27968	80563
	Conventional	32566	86642
Okra	Organic	105920	115067
	SPNF	29163	105789
	Conventional	33497	121903
Sesame	Organic	65020	70400
	SPNF	26718	41536
	Conventional	30830	85476
Black gram	Organic	76120	80628
	SPNF	27318	66592
	Conventional	29340	81210
Rice	Organic	63970	68899
	SPNF	28868	66583
	Conventional	30326	72234

Gross returns

Okra crop in combination with conventional management practices recorded highest gross returns (Rs 121903) which was followed by okra in combination with organic management practices (Rs 115067). Higher yields of vegetable crops and their higher pricing per kg over cereal crops are attributed to higher gross returns under conventional farming practises (Table 2). Similar results were obtained from Umar *et al*. (2011). Least gross returns were resulted under sesame in SPNF (Rs 41536).

Net returns

Highest net returns were resulted under okra in conventional management practices (Rs 88406) which was followed by okra in SPNF management practices (Rs 76626). Highest net returns under conventional management practices are may be due to low cost of fertilizers as compare to organic management practices (Table 3). Black gram in combination with organic management practices resulted in least net returns (Rs 4508). The increased cost of cultivation in organic farming due to high labor use and the high cost of vermicompost resulted in inferior net returns in organic farming. Similar findings are resulted by

Table 3. Effect of treatments on net returns and net returns per rupee invested.

Treatment	Net returns (Rs ha^{-1})	Net returns per rupee invested (Rs ha^{-1})
Crops	Management practices	*kharif* 2020
Maize	Organic	21052	0.33
	SPNF	52595	1.88
	Conventional	54076	1.66
Okra	Organic	9147	0.09
	SPNF	76626	2.63
	Conventional	88406	2.64
Sesame	Organic	5380	0.08
	SPNF	14819	0.55
	Conventional	54646	1.77
Black gram	Organic	4508	0.06
	SPNF	39275	1.44
	Conventional	51870	1.77
Rice	Organic	4929	0.08
	SPNF	37716	1.31
	Conventional	41908	1.38

Kumar *et al*. (2011).

Net returns per rupee invested

Okra in conventional management practices resulted in highest net returns per rupee invested (Rs 2.64) which was closely followed by okra in SPNF management practices (Rs 2.63) (Table 3). Low cost of cultivation due to less cost of fertilizers and high yielding ability of crops and ruminative price fetched by okra crop resulted in highest net returns per rupee invested (Kumar and Punam Seth 2020). Least net returns per rupee invested was resulted under black gram in organic management practices (Rs 0.06).

Based on the findings it was concluded that farmers of mid hills condition of Himachal Pradesh can adopt okra crop in combination with conventional management practices for higher yield and economic returns which was closely followed by okra in combination with SPNF.

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