

A Case Study of Dissemination of Pigeonpea Cultivation Technology in Hilly Areas of Uttarakhand

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ABSTRACT

Pigeonpea is a relatively new crop for north-west Himalayan region of India. The cultivation of Pigeonpea is found to be very beneficial for hilly areas farmers due to its compatibility in major hill farming systems, highly remunerative, capability to tolerate the slight drought condition and need for diversification in hill agriculture. A case study of dissemination of Pigeonpea cultivation technology in hilly area of Bageshwar district of Uttarakhand was conducted during 2008 to 2012. The study covered only rainfed area of three villages namely Karala, Tana and Naghar of Bageshwar block in Bageshwar district. PRA technique was used for the collection of data and information. Before 2008, the area under Pigeonpea cultivation in these villages was nil. After the adoption of Pigeonpea cultivation by the farmers of these villages, the area increased year by year from 0.08 hectare in 2008 to 16.08 hectare in 2012. The benefit:cost ratio of Pigeonpea cultivation was 3.60, which was significantly higher than soybean (1.72), horse gram (1.68), rainfed rice (1.56) and mandua (1.54). There was direct impact of adoption of Pigeonpea cultivation (Var. VL Arhar 1) in these three villages, which directly helped in raising the income of the farmers. This impact study also provided the information on the cultivation of Pigeonpea profitability and its effect on farmer's income. Non-availability of quality seeds (90.0%), insect-pest and diseases (83.33%), lack of knowledge of sowing time (76.66%) were the major constraints perceived by the farmers in adoption of Pigeonpea cultivation in these areas.

Key words: Pigeonpea, hill farming system, technology dissemination, adoption, benefit:cost ratio

INTRODUCTION

Pigeonpea [*Cajanus cajan* L] Millspaugh] is one of the major food legume crops of the tropics and sub-tropics. In India, after chickpea, Pigeonpea is the second most important pulse crop. It is mainly eaten in the form of split pulse as '*dal*'. Despite its main use as de-hulled split peas, the use of immature seeds is very common as fresh vegetable in some parts of India such as Gujarat, Maharashtra and Karnataka. Besides this, in the tribal areas of various states the use of Pigeonpea as green vegetable is very common (Saxena *et al.* 2010). Pigeonpea is a relatively new crop for north-west Himalayan region of India. Over 54 per cent of the total agricultural land in Uttarakhand state, is represented by hilly areas. The local topography and limited resources of the state restrict irrigation to only 50,000 ha leaving the remaining 405,000 ha of land entirely depending on rain water. Hence, mostly pulse crops grown in *kharif* season are green gram, black gram, horse gram, *etc.* which are adversely affected by various biotic (diseases and insects) stresses, leading to poverty and malnutrition in the region. At present, the total production of pulses in Uttarakhand is only around 50,000 tonnes, but the annual requirement of pulse in the state is 2,92,000 tonnes, leaving a vast deficit at the domestic level (Singh *et al.* 2009).

METHODOLOGY

Various extension approaches were undertaken by KVK scientists for the introduction of new crop of Pigeonpea through training, front line demonstration, group and individual discussion of KVK scientists with farmers, visits of farmers to KVK instructional farm, farmer-scientist interaction, method demonstration, result demonstration, field day, *arhar diwas*, *kisan goshti*, technical bulletin, magazine, literature, farmer fairs, exhibition, *uttarayani mela*, radio talk, TV talk and advisory services through mobile/telephone. These extension methods were used to promote the adoption of Pigeonpea cultivation in these villages.

The present study was conducted in the Bageshwar block of the Bageshwar district of Uttarakhand. Out of three blocks (Bageshwar, Kapkot and Garur), only Bageshwar block was purposely selected. In this block, three villages namely Tana, Karala, and Naghar were randomly selected. Participatory Rural Appraisal (PRA) technique was used for the collection of data and information. The data on the cost and returns aspect of Pigeonpea, soybean, horse gram, rainfed rice and mandua were collected through pre structured schedule. The data were collected during 2008 to 2012.

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RESULTS AND DISCUSSION

Besides its extra-short maturity, the variety, 'VL Arhar-1' is photoperiod sensitive as compared to medium duration varieties of Pigeonpea. These aspects together help in its adaptation to the locations characterized by high (up to 2,000 feet above sea levels) altitudes and wide (up to 40° N and S) latitudes (Saxena, 2008). In Uttarakhand, the sowing season for this crop is summer or *khari* season. The period 10th May to 05th June is considered as the optimum time for its sowing. The Pigeonpea germination starts in two weeks. The plant starts flowering in mid-August and harvested in end of October to first week of November.

In 2008, the KVK laid out 0.07 ha area under Pigeonpea (VL Arhar1) at Tana village of Bhageshwar district of Uttarakhand with total production (1.015q.) and the produce was used for home consumption. In 2009, 0.72 ha area was laid out under Pigeonpea FLDs at 23 farmers fields and income gain was ₹ 12, 200/-. In 2010, 1.08 ha area was laid out under FLDs of Pigeonpea at 37 farmers' fields with net income of ₹ 27,800/-. In 2011, 3.21 ha area was laid out under FLDs at 56 farmers' fields and net income gained was ₹ 1, 85, 000/-. In 2012, 7.84 ha area was covered under Pigeonpea FLDs at 62 farmers' fields and net income gained was ₹ 2, 77,000/- (Table 1).

Table 1: Yield performance Pigeonpea (VL Arhar 1) under FLDs laid out in Tana village of Bageshwar district during 2008-12.

Year	No. of farmers	Area (ha.)	Average yield (q./ha.)	Total production (q.)	Income (₹)*
2008	07	0.07	14.50	1.015	-
2009	23	0.72	14.75	10.62	12,200
2010	37	1.08	15.00	16.20	27,800
2011	56	3.21	15.50	49.76	1,85,000
2012	62	7.84	10.00	78.00	2,77,000

* Income generated after home consumption, friend & relative

In 2008, The KVK laid out 0.01 ha area under Pigeonpea FLDs at village Karala of Bhageshwar district of Uttarakhand with total production (0.15q) and the produce was used for home consumption (Table 2). In 2009, 0.36 ha area was covered under FLDs at 7 farmers' fields and total income gain was ₹ 14,400/-. In 2010, 29 farmers were selected for FLDs covering total area 2.20ha and the net income was ₹ 1, 25,000/-. In 2011, the KVK laid out 2.91 ha were under FLDs at 33 farmers' fields with net income of ₹ 1,71,000/-. In 2012, 35 farmers were selected for Pigeonpea FLDs covering total area of 4.05ha and total income gained was ₹ 1, 76,000.

Table 2: Yield performance of Pigeonpea (VL Arhar 1) under FLDs laid out in Karala village of Bageshwar district during 2008-12

Year	No. of farmers	Area (ha.)	Average yield (q./ha.)	Total production (q.)	Income (₹)*
2008	01	0.01	15.00	0.15	-
2009	07	0.36	15.00	5.40	14,400
2010	29	2.20	15.50	34.10	1,25,000
2011	33	2.91	15.60	45.40	1,71,000
2012	35	4.05	11.50	46.57	1,76,000

* Income generated after home consumption, friend & relative

In 2009, the KVK laid out 0.02 ha of area under Pigeonpea FLDs at Naghar village of Bhageshwar district and the total production was used for home consumption (Table 3). In 2010, 0.49 ha of area was covered under FLDs at 15 farmers' fields and total income gained was ₹ 7,832/-. In 2011, 2.39 ha of area was covered under Pigeonpea FLDs at 23 farmers' fields a with total income of ₹ 1, 45,000/-. In 2012, 4.21 ha of area was covered under Pigeonpea FLDs at 23 farmers' fields and net income earned was ₹ 1, 95,000/-.

Table 3: Yield Performance of Pigeonpea (VL Arhar 1) under FLDs laid out in Naghar village of Bageshwar district during 2009-12

Year	No. of farmers	Area (ha.)	Average yield (q./ha.)	Total production (q.)	Income (₹)*
2009	02	0.02	15.00	0.30	-
2010	15	0.49	15.25	7.47	7,832
2011	23	2.39	15.90	38.01	1,45,000
2012	23	4.21	12.00	50.52	1,95,000

* Income generated after home consumption, friend & relative

In 2008, the KVK laid out 0.08 ha area under Pigeonpea FLDs at 8 farmers' fields with total production of 1.18 q. which used for home consumption (Table 4). In 2009, 1.10 ha area was covered under FLDs at 32 farmers fields and net income gained was ₹ 26,600/-. In 2010, 3.77 ha area was covered under FLDs at 81 farmers' fields and net income gained was ₹ 1,60,632/-. In 2011, 8.51 ha area was covered under Pigeonpea FLDs at 112 farmers fields and net income gained was ₹ 5,01,000/-. In 2012, 16.08 ha of area was covered under Pigeonpea FLDs at 120 farmers fields and total income gained was ₹ 6, 48,000/-.

Table 4: Overall performance of yield of Pigeonpea (VL Arhar 1) FLDs laid out in Tana, Karala and Naghar villages of Bageshwar district during 2008-12

Year	No. of farmers	Area (ha.)	Average yield (q./ha.)	Total production (q.)	Income (₹)*	Seed production at farmers' field (q.)
2008	08	0.08	14.75	1.18	-	-
2009	32	1.10	14.92	16.41	26,600	1.5
2010	81	3.77	15.25	57.49	1,60,632	10.0
2011	112	8.51	15.67	133.35	5,01,000	30.0
2012	120	16.08	11.16	179.45	6,48,000	-

* Income generated after home consumption, friends & relatives

Remunerative cropping systems under rainfed conditions

Pigeonpea cropping sequences, were found to be more profitable for hills in rainfed area (Table 5). Besides, several other cropping systems, such as paddy-lentil, soybean-wheat, maize-lentil, maize-vegetable pea, paddy-toria and mandua-lentil were also found suitable for rainfed conditions in hilly areas.

Table 5: Profitability of suitable cropping sequences under rainfed conditions

Cropping sequences	Net Income (₹./ha.)	Cropping sequences	Net Income (₹./ha.)
Pigeonpea - Wheat	49,500	Maize – Lentil	27,300
Pigeonpea - Fallow	40,373	Maize – Vegetable pea	23,600
Paddy - Lentil	31,925	Paddy - Toria	22,925
Soybean - Wheat	28,530	Mandua - Lentil	22,230

Comparative profitability of Pigeonpea (*Cajanus cajan L.*) against Soybean (*Glycine max L.*), horse gram (*Dolichos biflorus L.*), rainfed rice (*Oriza sativa L.*) and mandua (*Elusine corcana*): The profitability of any crop production system is determined by estimating the cost of cultivation of the crop and gross returns accrued from it. The total production cost of Pigeonpea, soybean, horse gram, rainfed rice and mandua under rainfed conditions were comparable (Table 6). The costs to cultivate Pigeonpea included farm yard manure (32.7%), land preparation (12.3%), harvesting and threshing (10.6%), seed (10.6%), plant protection (9.0%), intercultural operation (8.2%), miscellaneous (10.0%), interest on working capital (4.3%) and sowing and thinning (2.3%).

The total cost amounted to ₹ 15,527/- per hectare for Pigeonpea, ₹ 15,700 per hectare for soybean, ₹15,100/- per hectare for horse gram, ₹ 16,500/- per hectare for rainfed rice and ₹ 13,541/- per hectare for mandua cultivation. The total value of the gross produce involving seed, sticks and straw was estimated at ₹ 55,900/- per hectare for Pigeonpea, ₹ 27,040/- per hectare for soybean, ₹ 25,490/- per hectare for horse gram, ₹ 25,860/- per hectare for rainfed rice and ₹ 21,700/- per hectare for mandua. The net returns were ₹ 40,373/- per hectare from Pigeonpea, ₹ 11,340/- per hectare from soybean, ₹ 10,380/- per hectare for horse gram, ₹ 9,360 per hectare from rainfed rice and ₹ 8,159/- per hectare from mandua. Accordingly, the benefit:cost ratio for Pigeonpea (3.60) was significantly higher than soybean (1.78), horse gram (1.68), rainfed rice (1.56) and mandua (1.54). These findings are supported by Sahu *et al.* (2010), Sahu *et al.* (2011) and Saxena *et al.* (2011)

Table 6: Comparative profitability of Pigeonpea vis-à-vis other crops in Bageshwar district

Crops	Product	Yield (q./ha)	MSP (₹/q)	Gross income (₹/ ha)	Cost of cultivation (₹/ ha)	Net returns (₹/ ha)	B. C. ratio	Rank
Pigeonpea (VL Arhar 1)	Seeds	16.0	3,200*	55,900	15,527	40,373	3.60	I
	Sticks	40.0	100**					
	Straw	10.0	70**					
Soybean (VL Soya 47)	Seeds	16.0	1,690*	28,090	15,700	12,390	1.78	II
	Straw	15.0	70**					
Horse gram (VL Gahat 8)	Seeds	8.5	2,900**	25,490	15,100	10,380	1.68	III
	Straw	12.0	70**					
Rainfed rice (Vivek Dhan 154)	Seeds	22.0	1080*	25,860	16,500	9,360	1.56	IV
	Straw	30.0	70**					
Mandua (VL Mandua 324)	Seeds	18.0	1050*	21,700	13,541	8,159	1.54	V
	Straw	40.0	70**					

*Minimum support price, **Local price

The constraints faced by Pigeonpea farmers are presented in Table 7. It was observed that the major constraints perceived by the farmers were non-availability of quality seed (90%), insects and diseases (83.33%), lack of knowledge of sowing time (76.66%), marketing (70%), scattered and small land holding (60%) and lack of awareness of more profitable crop (53.33%) than soybean, horse gram, rainfed rice and mandua.

Table 7: Constraints faced by Pigeonpea growers in hilly areas n-120

Constraints	Frequency	Percentage	Rank
Non availability of quality seeds	108	90.00	I
Insects and diseases (Bristle beetle)	100	83.33	II
Lack of knowledge of sowing time	92	76.66	III
Lack of awareness of more profitable crop	64	53.33	VI
Scattered and small land holding	72	60.00	V
Marketing	84	70.00	IV

CONCLUSION

The study revealed that the marginal and small farmer's income was found to be increased due to Pigeonpea cultivation. The benefit:cost ratio of Pigeonpea cultivation was 3.60 which was significantly higher than soybean (1.78), horse gram (1.68), rainfed rice (1.56) and mandua (1.54) in rainfed conditions of

hilly areas. The Pigeonpea cultivation has spread to 16.08 hectares during five years in three villages under study. Non-availability of quality seeds, insect (Blister beetle and diseases) and lack of knowledge of sowing time were the major constraints in adoption of Pigeonpea by the farmers. Therefore, it may be concluded that the Pigeonpea cultivation technology is suitable for rainfed areas in north-west Himalayan region of India, which in turn can increase income of hilly areas farmers.

Paper received on : July 09, 2014
Accepted on : August 06, 2014

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