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SHORT COMMUN ICATION

Papaya cultivation brought socio-economic and nutritional security in Sirohi tribals of Rajasthan: A case study

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Cultivation of fruits played a pivotal role in diversification of agriculture alongwith food and nutritional security of ever growing population. Papaya (*Carica papaya*) is a tropical fruit having commercial importance because of its high nutritive and medicinal value. India leads the world in papaya production with an annual output of about 3.6 million tonnes (Anonymous, 2009). Sirohi is among the top districts in papaya cultivation in Rajasthan. Presently, papaya is an important fruit crop of the district and cultivated in 563 ha. (Anonymous, 2011). It is used as ripened fruit and vegetable and easy to digest. Papain prepared from dried latex of its raw fruits is used in meat tendering, manufacturing chewing gum, cosmetics, for degumming silk and to give shrink resistance to wool. In addition, it is also used in pharmaceutical, textile and garment industries, cleaning paper and adhesive manufacturing, sewage disposal and so on (Anonymous, 2002). The average yield of papaya is 550 q ha^{-1}, but the farmers were facing some problems in papaya cultivation like availability of quality seed and seedling, pollination problems due to single sex plant, lower shelf-life of fruit, fruit marketing, lack of advance knowledge about papaya production, resulting in poor plantation and lowered economic return. So, KVK, Sirohi has developed institutional and technical models for poverty alleviation, sustainable development in agriculture and equitable development of rural farmers and raised the income of tribal's by providing them quality training in various aspects of horticulture (especially papaya production), technical resources (demonstration, exposure visit, exhibition), technical guidance for agricultural inputs (seed, fertilizer and pesticides), quality planting material (papaya seedling variety Red lady), formation of farmers interest groups (papaya village) and marketing (harvesting, grading, packing and transportation) of papaya fruits. The Taiwan Red-Lady variety of papaya fruit has brought smile on the faces of several papaya farmers in Sirohi district. The imported variety of the fruit has brought wonders owing to its great quality, long shelf life, hermaphrodite nature, fruit taste and, of course, profitability. KVK provided quality seedling of variety Red lady with locally standardized package of practices and formed papaya growers groups for increased papaya plantation. Farmers groups or organizations were to protect and increase the interest of farmers, increase production, enhance knowledge and skills, use of appropriate technologies and improving quality of life (Shan, 1995). Nutrition garden is especially important in rural areas where people have limited income-earning opportunities and poor access to markets. Home gardens are also becoming an increasingly important source of food and income for poor households in rural tribal areas. These gardens have an established tradition and offer great potential for improving household food security and alleviating micronutrient deficiencies. A well-developed home garden has the potential, when access to land and water is not a major limitation, to supply most of the non-staple foods that a family needs every day of the year, including roots and tubers, vegetables and fruits, legumes, herbs, spices, animals and fish. Roots and tubers are rich in energy and legumes are important sources of protein, fat, iron and vitamins. Green leafy vegetables and yellow- or orange-coloured fruits provide essential vitamins and minerals, particularly folate, and vitamins A, E and C and other bio-active compound. Papaya fruit is a rich source of vitamin A and C with different minerals. It has a high nutritive and medicinal value, so provide nutritional security to the rural and tribal families (Mohanty, 2012 and Nayak *et al.,* 2012).

The study was conducted in the working area of Krishi Vigyan Kendra-Sirohi. Main target group was tribal farmers engaged in papaya cultivation. The farmers groups were divided in two categories on the basis of crop production i.e. field crop grower and field crop grower with papaya cultivation. The present study was conducted to know the impact of papaya production on socio-economic development and nutritional security of farmer's families. All the

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commercial papaya growers were main respondents for collection of socio-economic observations from whole district. Data was collected from selected five villages of the district for measuring nutritional security through backyard nutritional gardening. From each village 50 farm women and total 250 women were selected through equal allocation using purposive sampling technique with the hope of representing the whole experimental area.

For this study a well designed questionnaire was developed and pre-tested. Primary data was collected with the help of a questionnaire. For studying socio-economic impact all the prominent commercial papaya growers (243 farmers) were interviewed. Two hundred fifty farm women respondents of the selected five villages were interviewed for nutritional security observations during experimentation of last four years. The respondents were interviewed in their houses, farms, gram sabha meetings and working labour was interviewed directly at the time of working at papaya fields. These places were selected for the convenience of respondents and for creating congenial situation, where both sides (researcher and respondent) exchanged their views frankly and informally by the help of local personnel (village level workers). The questionnaire mostly contained closed end questions and it was designed in English but the questions were asked in Hindi and local language (Marwari) in order to avoid confusion. During interview every effort was made to explain the questions and its purpose, to collect correct and reliable information. For supporting the results of primary data (labour record of progressive farmers), the secondary information was collected from published and unpublished sources. After collection of data, a tally sheet was prepared which facilitated the enumeration of answer of each question. By using descriptive statistics the data was analyzed by calculating simple percentages. The data was arranged in tables in very simple manner for clarity.

Contribution in district economy

The results shown in Table 1 indicated that papaya cultivation played very important role in district economy since last four years. Due to short duration, high yield, good market value the farmers started earning three to four times more than field crops production. More than 2.36 lakh papaya plants were planted in 95 hectare area. Out of total plantation, 13 per cent plants got damaged before production, remaining plants (2.05 lakhs) were producing 89.0 kg fruits during economic production life. Total production of papaya during last four years was 18.19 thousand tonns and their market value was Rs. 14.57 crores (3.64 crores per annum) (Table 1). Total net return of papaya was Rs. 12.02 crores (3.00 crores per annum) with 4.77 benefit: cost ratio as reported during experimentation (2008-2011) in the district. Number of farm families involved in papaya production was 243 and in primary processing of papaya was 155 with 40,565 mandays employment generation during last four years (Table 1). Similar results were also reported by Biswas (2010) mentioning that papaya produces more income per unit area only next to banana and have high nutritive and medicinal value.

Contribution in nutritional security

The results in Table 2 depicted that the nutrition garden with papaya plants play very important role in increased fruit consumption of the rural families. Before establishment of nutrition garden average fruit consumption was very low (161.0 kg/year), whereas in papaya based nutrition garden (5-15 plants) fruit consumption of the farm families increased and started consuming 280 kg more fruits than without nutrition-garden families. Similar results were also reported by Mohanty, 2012 and Nayak *et al.* 2012.

Effect on socio-economic status

The results in Table 3 depicted that the papaya grower earned 111.11 per cent more than field crop growers. By adopting papaya cultivation, employment generation increased upto 192 mandays /ha, which means an increase of about 18240 mandays in 192 ha area of the district. Socioeconomic status of tribal farmers was directly affected by papaya cultivation. The papaya producers made cemented houses (37%), purchased utility facilities like radio, T. V., C. D. player, bed, storage bin etc. (40%), maintained bank account with more than Rs. 10,000 balance (52%), gave good education to children (27%), purchased improved agricultural implements (32%), had active participation and interaction with extension workers (68%), had personal transportation facilities (58%), maintained telephone or mobile facilities (42%), greater adoption of new technology (42%), better understanding of urban society (27%), greater awareness about health and hygiene (27%), participation in social works (29%), change in behavior and thought (28%). Women participation in decision making was also increased by adoption of papaya production (32%) as compared to 15 per cent in field crop growers respondents. Biswas (2010) and Bhardwaj *et al.* (2011) also reported that the growing of papaya played significant role in the socio-economic development of the country as provider of food, foreign exchange earner, employment and income generator.

Effects of various constraints identified in popularizing papaya cultivation

The results in Table 4 showed that there were different problems faced by the respondents of the study area. The field crop growers faced more problems than

the papaya growers. The papaya growers faced minimum problems, like capital problem (20%), adoption of technology (32%), availability of technology (32%), marketing problems (48%), credit availability (37%), restriction of society (15%), transportation (25%), distance from market (35%), education facilities (30%), water scarcity (50%), fruit glut (20%), lack of regulated market (25%), lack of storage facilities (40%), exploitation by commission agent (17%), availability of quality seed and seedling (15%) and transportation of seedling (22%). Similar results were also reported by Ahmad *et al.* 2007; Bhardwaj *et al.* 2011.

In tribal and rural areas poverty is also a major problem due to lack of capital. Farmers faced difficulties in obtaining credit which is generally due to the lengthy and time consuming procedure, illegal demands of revenue staff and bank functionaries. Market plays a dual role i. e. supply of inputs and consumes farmer's surplus produce. There was no proper formal market available in the study area that would enable the farmers to the sell their products in time. Lack of transportation facilities was the main hurdle in marketing of fruits. Availability of input supply like seedling, pesticides, fertilizer, and advance technology like hi-tech horticulture facilities was greatly affected due to the distance from market. Lack of irrigation facility and good quality water was a big constraint in raising papaya. The fruit being perishable in nature poses problem in marketing. Development of infrastructure facilities for transportation to primary markets, standardization of packaging techniques are aspects which need special attention. Processing facilities also need to be created in the area for value addition.

The interventions of Krishi Vigyan Kendra Sirohi relating to popularization of papaya production by supply of quality seedling, farm inputs, training opportunities and field demonstrations increased the quality production of papaya manifold and contributed immensely to socio-economic development of the tribal farmers in Sirohi. A significant change was observed in

Table 1. Income and employment generation through papaya production and primary processing in district Sirohi

Particulars	Year of papaya plantation			
	2008-09	2009-10	2010-11	2011-12
Source of papaya plants				
Papaya seedlings prepared by farmers	9850	14500	20000	12700
Seedlings prepared by KVK-Sirohi	24970	20000	14900	11750
Seedlings prepared by private nurseries	25000	24441	32453	25569
Total plantation in last 4 years	59820	58941	67353	50019
Total area in papaya cultivation (ha) (2 x 2 meter spacing)	24.0	24.0	27.0	20.0
Field mortality and other damage of papaya plants (13%)	7777	7662	8756	6502
Total fruit producer plants	52043	51279	58597	43517
Average yield of papaya/plant (kg) (In two-three year economic life of papaya)	85.0	85.0	90.0	95.0
Total yield of papaya (ton)	4423.65	4358.71	5273.73	4134.11
Average market rate (on field marketing), (70% farmers sale on field)	5.0 (3096.56 ton)	6.0 (3051.10 ton)	6.0 (3691.61 ton)	7.0 (2893.87 ton)
Average market rate (whole sale in market) (20% farmers sale on field)	10.0 (884.73 ton)	10.0 (871.74 ton)	11.0 (1054.74 ton)	13.0 (826.82 ton)
Average market rate (retail marketing) (10% farmers sale on field)	15.0 (442.36 ton)	15.0 (435.87 ton)	17.0 (527.38 ton)	18.0 (413.41 ton)
Total income (Rs. in lakhs)	309.655	335.6205	427.1726	384.4713
Net income (Rs. in lakhs)	249.66	272.02	352.92	328.47
B:C ratio	4.16	4.28	4.75	5.87
Number of farm families involved in papaya production	50	65	72	56
Number of farm families involved in papaya primary processing	35	40	43	37
Total employment generation per year (man days/annum)	10248	10248	11529	8540

socioeconomic condition of respondents as they started earning upto Rs. 2.25 lakh/ha per annum. Papaya based nutrition garden increased fruit consumption of the farm families. Thus, papaya production proved a milestone in tribal farmer's empowerment by providing social, economic, employment, health and nutrition security. Based on the findings of this research work, it can be concluded that papaya growers are the key persons for improving their socio-economic status. Also, they faced certain problems like inadequate support from government and donor agencies for credit facilities, access to markets, storage facilities, appropriate technology and small farm machineries which need to solved.

Table 2. Contribution of papaya plantation in nutritional security through backyard nutrition gardening

Particulars	Year of backyard nutritional garden establishment			
	2008-09	2009-10	2010-11	2011-12
Establishment of backyard nutritional garden	825	1113	1530	1532
Number of plants in nutritional garden	5-15	5-15	5-15	5-15
Survived plants in nutritional garden	8	7	6	7
Average yield of papaya (kg) (40 kg/year upto 3 years)	320	280	240	280
Average fruit intake of family before gardening (kg/year)	150	162	157	175

Table 3. Socio-economic impact of papaya plantation on respondent groups

Essential components	Field crop grower	Field crop grower with papaya cultivation
Average annual income (Rs.)	135000	285000
Employment generation (mandays/ha)	235	427
Construction of cemented houses	13.0	37.0
Utility facilities (Radio, TV, CD player, bed , storage bin etc.	19	40
Bank account with more than Rs. 10000 balance	17	52
Children education in good school	15	27
Improved agricultural implements	15	32
Participation and interaction with extension workers	35	68
Personal transportation facilities (cycle, motorcycle, car)	20	58
Adoption of new technology	17	42
Understanding about urban society	17	42
Awareness about health and hygiene	19	27
Participation in social works	23	29
Change in behaviour and thought	16	28
Telephone and Mobile facilities	30	47
Women participation in decision making	13	32

Table 4. Effect of various constraints identified in popularising papaya plantation in tribal areas

Constraints	Field crop growers	Field crop grower with papaya cultivation
Capital problem	52	20
Adoption of technology	63	32
Availability of technology	65	32
Marketing problems	52	48
Production technology of papaya	65	15
Credit availability	60	37
Restrictions of society	42	15
Transportation	55	25
Distance from market	57	35
Education facilities	70	30
Water scarcity	60	50
Fruit glut	00	20
Lack of regulated market	30	25
Lack of storage facilities	28	40
Exploitation by commission agent	35	17
Availability of quality seed	00	15

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