

Role of Horticultural Crops in Watershed Development Programmes Under Semi-Arid Sub Tropical Dryland Conditions of Western India

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Abstract: To assess the economic impact of watershed development programmes in a traditional semi arid subtropical rainfed agro ecosystem of Bhilwara district in Rajasthan, 40 farmers each in watershed and Non - watershed areas were interviewed five years after the watershed works were completed. Balesariya watershed development programme increased ground water availability by 1.5m to 1.8 m above the previous water level. Horticultural crops including seed spices like cumin, coriander and chilli (dry) and vegetables like cabbage, cauliflower and tomato and perennial tree fruit like aonla were compared for their performance along with traditional dryland crops like mustard, taramira, chickpea (gram), green gram, black gram, horse gram and sorghum + red gram (3:1 ratio) under watershed and non watershed conditions for their yields and economic returns. Crop yields and net profits increased in all the commodities when they were raised in a watershed. Inclusion of horticultural crops in the system yielded more returns than traditional crops in a watershed area on a sustainable basis. A net profit of Rs 100,500 / ha was realized by growing cumin with 2—3 irrigations in a watershed.

Keywords: economic analysis, horticultural crops, seed spices, watershed development

1 Introduction

Environmental degradation is now recognized as an issue of concern in the developing world. With the increasing population pressure, the basic necessities of mankind such as food, fodder, fuel and fibre are becoming scarce. Geophysical and socio-economic constraints in augmenting irrigation resources have left Indian Agriculture to focus major thrust at rainfed farming to enhance production for meeting the ever increasing demands of the world's largest democracy. This puts tremendous pressure on the already fragile rainfed agro ecosystems wrought with multidimensional problems, all leading to severe and accelerated erosion. The need of the hour is to conserve and manage these ecosystems not only to achieve higher productivity for the present but also to sustain it on a long term basis.

Huge sums of money were spent for relief works during drought years with lack of direction or vision in solving the problem on a permanent basis. There were no follow up measures either. The development programmes when organized on individual problems they became less effective. Hence it was felt more appropriate that the area development approach was more effective than individual problem oriented approach. Soil, water and vegetation are the most important resources and proper management of these resources is essential for the success of agriculture in any area.

Watershed approach, apart from recognizing the importance of geo-hydrological relationships in planning sustainable conservation measures also assess the land capability and its carrying capacity. Watershed management, through improving and stabilizing the productivity of rainfed agro ecosystem, is also expected to improve the socio-economic conditions of people living below the poverty line. Large amount is spent on watershed development in the country with Rajasthan being an important state in implementing the programme.

2 Material and methods

To assess the economic impact of watershed development on the rainfed farmers an investigation was taken up in the Balesariya micro watershed under National Watershed Development Programme on

Rainfed Agriculture (NWDPR) in Bhilwara district of Rajasthan. Bhilwara district is situated between $25^{\circ} 1'$ and $25^{\circ} 58'$ North latitude and $74^{\circ} 1'$ and $75^{\circ} 28'$ East longitude. The total geographical area of the micro watershed was 4,942 ha comprising of 2,183 ha of arable land, 2,549 ha of non arable land both being covered under effective project area and 211 ha being classified as the area not available for the watershed project. The villages covered under the watershed are Baran, Balesariya, Hatipura, Dudala, Nanakpura, Payaran and Daute. The project was completed with an estimated out lay of Rs 15.79 millions. The beneficiaries under the project were as detailed in Table 1.

Table 1 Targeted beneficiaries of balesariya watershed

S.No.	Category	No. of house holds
1.	Marginal farmers (< 1 ha)	1,509
2.	Small Farmers (1ha—2 ha)	921
3.	Medium Farmers (2ha—4 ha)	598
4.	Large Farmers (> 4 ha)	142
Total		3,170

$$\text{Average cost of project per hectare} = \frac{\text{Rs}1,57,90,000}{4,732\text{ha}} = \text{Rs}3,338/\text{ha}$$

Balesariya watershed is located 25 km from Bhilwara District Head quarters on Bhilwara - Ajmer State Highway. The watershed works were completed by 1995. The major source of water was found to be rain alone with the major source of irrigation being wells. The rainfall pattern for 11 years prior to the completion of watershed works were as detailed in Table 2.

Table 2 Rainfall pattern in Balesariya watershed (1985—1995)

Year	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Rainfall (mm)	662	567	418	300	822	800	620	554	396	1,083	980
Average of 11 years						654.72 mm					

The soils are medium to fine textured. The watershed area is characterized as semiarid with highest temperature being 46°C in June 1994 and a minimum being 5°C in Jan 1995. The entire area is plain with almost level to generate gentle sloping land. The slope is from SW to NW.

To control erosive velocity of run off water and to control soil erosion, loose stone check dams, vegetative check dams, sunken ponds and nadies have been constructed in drainage line with an idea of increasing the soil fertility as well as ground water recharging of wells.

A Rapid Rural Appraisal was under taken as a part of the projected works under National Agricultural Technology Project on "Socio – Economic Evaluation of Rainfed Technologies in different areas of Watershed Development Programmes in India". Data were collected from 40 watershed farmers and an equal number of farmers from outside the watershed for comparison. Data were collected during 2001 cropping season, five years after the watershed works were completed in order to assess whether any tangible or intangible benefits were accrued to the targeted beneficiaries and also whether horticultural crops were remunerative with protective irrigation where ever available. To fulfill the said objectives a questionnaire was prepared and the answers were collected from the farmers. The horticultural crops included for the study were seed spices like cumin, coriander and chillies and vegetables like cabbage, cauliflower and tomato and aonla fruit. The traditional dryland crops included mustard, taramira, chickpea, green gram, black gram, horse gram and sorghum + red gram.

3 Results & discussion

The Balesariya watershed development programme increased ground water availability by 1.5 m to 1.8 m above the previous water level. Average yield levels in general increased in all the commodities under study in the watershed area when compared to non watershed area (Table 3). Poor yields in Non – watershed areas may be attributed to low and erratic rainfall (Table 2) and water table being far away from the root zone in the absence of watershed works to prevent erosive velocity of rain water and there by erosion of soil, water and nutrients. Annual soil losses at the farm level have been estimated at 16.4 t/ha in the smaller Watersheds of Damodar Valley Catchment (Kumar, 1990). In horticultural crops, percentage increase in the yields in watershed areas ranged from 38.64 in tomato to 159.67 in cumin. A tremendous increase in the yields was observed in seed spices and aonla. Cumin performed well in the watershed area with a whopping average yields of 22 quintals / ha. This may be due to 2—3 irrigations provided at field capacity in the watershed areas. The experience of the farmers showed that more than 4 irrigations were found detrimental to the crop growth and final yields in cumin. It was observed that this might cause wilt in the crop. The diurnal temperature differences are conducive to growth and yields of cumin in Bhilwara district of Rajasthan. Coriander followed by chilli too performed well with regard to the crop yields like cumin in the watershed area. Although there was a moderate increase in the yields of cabbage, cauliflower and tomato in the watershed areas they were not as remunerative to the farmers as with seeds spices and aonla because of low market prices available to the farmers. Budded aonla plants started bearing some fruits from the sixth year onwards and good yields were realized from 12th year onwards. On an average by taking the average yields from 1st to 15th years it was next only to cumin. The edaphic and climatic factors at Bhilwara districts are favourable for aonla growth.

Among the traditional dryland crops mustard and taramira performed well in the watershed area followed by sorghum, chickpea, horse gram, black gram, red gram and green gram.

By growing mustard, taramira and chickpea in watershed areas more yield levels could be realized than growing cabbage, cauliflower and tomato in such areas (Table 3).

Table 3 Yield variation pattern in watershed (WS) and non – watershed (NWS) areas

S.No.	Commodity	Average yield (Quintals / ha)		Av. Market price Rs • /kg produce
		NWS area	WS area	
1.	Chilli (dry)	10.35	22.00 (112.56)	25
2.	Coriander	6.70	15.25 (127.61)	20
3.	Cumin	3.62	9.40 (159.67)	130
4.	Cabbage or Cauliflower	33.50	47.00 (40.30)	3
5.	Tomato	84.75	117.50 (38.64)	2
6.	Aonla (Av. Of 15 years after planting)	22.47	56.00 (149.22)	10
7.	Mustard	8.45	14.23 (68.40)	13
8.	Taramira	8.73	14.29 (63.69)	10.5
9.	Chickpea (gram)	8.15	12.50 (53.37)	15
10.	Green gram	5.80	7.01 (20.86)	16
11.	Black gram	4.90	6.56 (33.88)	16
12.	Horse gram	4.85	6.50 (34.02)	6
13.	Sorghum + Red gram (3:1 ratio)	8+2.1	15 + 2.8 (187.50 + 33.33)	5 + 14

Figures in parentheses indicate percentage increase of commodities over the respective yields in non – watershed areas.

Economic analysis

The expenditure to raise horticultural crops in one hectare area was in general higher than that of traditional dryland crops (Table 4). It ranged from Rs. 7,900 / ha in coriander to Rs.21,500 in cumin in horticultural crops and Rs. 1,200 in horse gram to Rs. 8,900 in mustard in traditional dryland crops of Rajasthan. Gross and net returns too were much higher with horticultural crops in comparison to traditional dryland crops even when they were grown in a watershed area. Highest income: cost ratio (6.26) and net profits (1,005,000) were realized by growing cumin closely followed by aonla (5.60 and Rs. 46,000 respectively). Raising chilli or coriander was even more profitable than raising vegetable crops like tomato, cabbage and cauliflower. Moreover cabbage, cauliflower and tomato being shallow rooted with succulent leaves, inflorescence parts and fruits, as vegetables require large quantities of water. One has to maintain soil moisture regime at 1.6 bars in upper 60 cm soil profile to get a yields of 50 t or more per ha (Bhagavantagoudra *et al.*, 2000).

Given the option between chilli and coriander it is advisable to raise coriander because with less expenditure (Rs. 7,900 / ha) almost similar profit levels were realized than with chilli which required a comparatively higher investment (Rs. 20,500), the amount which was closer enough to raise cumin crop in one ha area.

More number of small and marginal farmers who were more in number but with less investment potential might go in for cultivation of coriander rather than chilli. When they got capability to invest on chilli, they should rather invest upon raising a cumin crop which is much more profitable under the situation of existing cultivation practices and market forces. Their animals could be fed with free grasses available on the community land / government land.

With the traditional crops the gross and net income levels were much lesser than those of horticultural crops. Among the traditional crops specific to the area maximum profit was obtained from mustard closely followed by chickpea. With other crops the net profit was less than Rs 5,500 / ha.

With the expenditure incurred in raising mustard or chickpea or taramira one can raise coriander and earn a net profit of Rs. 22,500 / ha which was more than 2 times with that of mustard or 3 times with taramira or 2½ times with chickpea.

When the net profits of all the commodities under study were converted into cumin equivalent net profits, it was observed that none of the traditional dryland crops crossed 10 % levels although they were grown in the same watershed area. Among horticultural crops aonla followed by chilli and coriander could get 45%, 24% and 22% of cumin equivalent yields respectively.

Table 4 Economic evaluation of horticultural crops vis-à-vis traditional dryland crops in a watershed area (per ha area)

S.No.	Crop	Expenditure (Rs.)	Gross Income (Rs.)	Income: cost ratio	Net profit (Rs.)
Horticultural crops					
1.	Chilli (dry)	20,500	55,000	3.88	24,500 (24.38)
2.	Coriander	7,900	30,500	3.86	22,500 (22.49)
3.	Cumin	21,500	122,000	6.26	100,500 (100)
4.	Cabbage or Cauliflower	12,800	30,000	2.34	17,200 (17.11)
5.	Tomato	9,000	23,500	2.60	13,500 (13.43)
6.	Aonla (Av. Of 15 years after planting)	10,000	56,000	5.60	46,000 (45.77)
Traditional dryland crops					
7.	Mustard	8,900	18,500	2.07	9,600 (9.55)
8.	Taramira	7,800	15,000	1.91	7,200 (7.16)
9.	Chickpea (gram)	9,800	18,750	1.91	8,950 (8.91)
10.	Green gram	5,800	11,200	1.93	5,400 (5.37)
11.	Black gram	5,600	10,500	1.87	4,900 (4.85)
12.	Horse gram	1,200	3,900	3.25	2,700 (2.69)
13.	Sorghum + Red gram (3:1 ratio)	7,400	11,400	1.54	4,000 (3.98)

Figures in parentheses indicate percentages of respective commodity net profits in cumin equivalent profits.

A large number of house holds (3,170) are benefited by Balesariya watershed at an average cost of Rs 3,338 / ha. Soil conservation technologies, which require substantial establishment cost and higher labour and other external inputs become cost effective as population densities increased (Singh, 2001). The expenditure incurred in the Balesariya Watershed Development Programme is justified since the targeted groups are reaping the rich rewards.

4 Conclusion

Raising seed spices like cumin with 2—3 protective irrigations or coriander with no irrigation and with less investment in Balesariya watershed was found more remunerative with an expected net profit of Rs.100,500 / ha and Rs.22,600 / ha when compared to traditional crops to the region like mustard, taramira, chickpea, green gram, black gram, horse gram and sorghum + red gram. Even vegetables like cabbage, cauliflower and tomato were more remunerative than traditional dryland crops. Farmers in the region were convinced to take up more watershed works and include seed spices and other horticultural crops in the watershed area.

References

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