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Deceitful Catchment Area for the Development of Agriculture and Horticulture Aspects in the Himalayan Region

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The glaciers and annual snowfalls in the Himalayan region feed rivers serving 47% of the world's population. No other region in the world has the comparable number of people, scarcity of rainfall, dependence on agriculture, tempting sites for mega-projects and vulnerability to climate change.

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Being a part of north-western Himalayan region, the catchment development (CD) block of Banjar in the district Kullu of Himachal Pradesh has 49 Micro Watersheds (MWs) out of which 4 are snow bound and are inaccessible to carry out any developmental activity. In order to do socio-economic study and assess the extent of Horticultural, Agricultural, Vegetable Production and Animal Husbandry development, NERIL conducted field survey in all these Community Development Blocks in 2012. For the purpose of this survey, the random sampling size comprised of minimum 10% of the revenue villages and 5 nos. of households up to a total of 250 households. In case of households exceeding 250 nos. an additional household was surveyed for an increase of every 50 households thereafter. As per these criterion 177 households in CD Block Kullu. The block has 10858 ha area owned by the farmers in which various agricultural activities including vegetable cultivation and animal husbandry are carried out. Additionally, 7254 ha area is available for the cultivation of different fruit crops viz. apple, plum, pomegranate, peanut, persimmon and walnut. The Block has 6935 ha area on which various cereal and vegetable crops are grown. Among the cereal crops, Maize dominates during Kharif season whereas Wheat and Barley are the main crops during Rabi season. Themaize accounts for 84.2% of the cropped area during Kharif season whereas wheat accounts for 82.2 % of the cropped area during Rabi season. The vegetables are grown on 1360 ha (cropped) area in the block. The most preferred vegetable crops are peas, garlic, cauliflower and cabbage. They are grown by 60.7, 45.6, 24.4 and 11.2 % farmers respectively. The farmer's feed good amount (3.5 kg) of concentrate per cattle per day.The average milk yield of improved breeds is 5.6 liter per day whereas that of local cows is about 2.7 liter perday. The most discouraging feature of the animal husbandry activity has been negligible availability of green fodder. On the above survey data were concluded that, a total sum of Rs. 592.52 lacs will be required to bring the desired improvement in the economy of farmers at least partially and conserve the soil and water to reduce the silt load of the river water system in near future.

Keywords: Agriculture; horticulture; animal husbandry; watershed; vegetable.

1. INTRODUCTION

In recent years, India has looked to watershed development as a way to realize its hopes for agricultural development in rain fed, semi-arid areas. These areas were bypassed by the Green Revolution and have experienced little or no growth in agricultural production for several decades [1,2]. The agriculture (rain-fed) contributes 58 per cent to world's food from 80 percent agriculture lands (Raju et al., 2008). As a result of global population increase, water for food production is becoming an increasingly scarce resource, and the situation is becoming worse because of climate change [3]. The rain-fed areas are the centre of poverty, malnutrition, food insecurity, water security, severe land degradation, and poor social and institutional infrastructure Rockstorm et al. [4]; Wani et al. 2007. Watershed development program is, therefore, considered as an effective tool for dealing many of these problems and recognized as potential engine for agriculture growth and development in fragile and marginal rain-fed areas Joshi et al. 53]; Ahluwalia and Wani, 2006. Management of natural resources at watershed scale produces multiple benefits in terms of increasing food production, improving livelihoods, protecting environment, addressing gender and equity issues along with biodiversity concerns Sharma, 2002; Wani et al. [6], b; Joshi et al. [5]; and Rockstorm et al. [4]. By keeping these things into consideration, Himachal Government in 2006 launched Swan River Integrated Watershed Management Project in Una District of Himachal Pradesh with the assistance of Japan International Cooperation Agency (JICA) at a cost amounting to Rs 3493 million. Catchment areas of the Swan River in Himachal Pradesh are located in the fragile and vulnerable Shivalik hills where the river frequently overflows its banks during the monsoon causing erosion of soil resources [7-11]. The project activities include afforestation, civil works for soil and river management, soil protection and land reclamation and livelihood improvement activities, thereby, improving the living conditions of people [12-16]. The CD Block Banjar has 49 MWs (Fig. 1).

Watershed development is one of the popular approaches among development planners and agricultural scientists because it promises a win-win situation as far as natural resource conservation and agricultural productivity are concerned. Ingle and Kude [17], evaluated the watershed development programmes at Akola in Maharashtra and analysed the changes in cropping pattern over a period of 5 years (1983-

84 to 1988-89) of watershed development. The results indicated that over the time there was a gradual change in the allocation of areas especially during the Kharifseason. The area under cereals, cotton and pulses decreased by 3.09, 0.13, and 2.95 per cent, respectively while the area under dry land fruit crops (0.94 percent) and forestry (0.09 percent) increased marginally during the period. Based on the study on economic evaluation of watershed programme on crop yields of different crops in Madhya Pradesh, the crop yields within watershed area were higher as compared to non-watershed areas Rajput et al. [18]. Singh and Jain [19] evaluated the impact of Kandi Watershed and Area Development Project (KWADP) in Punjab for two periods (1979-80 and 2000-01). The study indicated that the percentage of cultivated area increased from 19.4 to 55.3% and the cropping intensity increased from 113.7 to 143.1%. The productivity of maize, wheat and milk in 1979-80 was estimated to be 1017 kg/ha, 1084 kg/ha and 928 litre/cattle, respectively, whereas the corresponding figures for 2000-01 increased to 1879 kg/ha, 2574 kg/ha and 1233 litre/cattle. Mishra et al, 2013, 2019, 2020, 2021) have contributed on challenges of agriculture and how traditional ecological knowledge may be beneficial in crop and livestock management of various watersheds in Sikkim Himalaya.

2. MATERIALS AND METHODS

The methodology adopted for the present area includes the collection of data:

- By observation and discussion with local people
- By personal interviews of the local people.
- Through Questionnaires prepared and getting filled them by people
- Through Social Mapping of the areas for developing the social relationship with the local people.

The secondary data of agricultural crops, horticultural crops, vegetable crops and animal husbandry data's were taken field investigation and as well as it is taken from different departments and projects of Himachal Pradesh Government (Block Development Office/Distt. Statistical Office, NERIL (Naik Environment Research Institute Ltd i.e. NERIL)/hpkullu.nic.in, Cost norms as per Hort.Tech. Mission, GOI/Deptt.of Hort. H.P., Deptt. of Agri. H.P norms, Dept. of Animal Husbandry, H.P. norms and Mid Himalayan Project norms). (Survey by Naik Environment Research Institute Ltd i.e. NERIL).

During the field investigation the Block has 7254 hectare area under Horticultural Crops of different fruit crops. The Block has 7254 hectare area under Horticultural Crops ofdifferent fruit crops. The predominant fruit crops comprised of Apple, Plum, Pear, Pomegranate, Pecnut, Apricot, Persimmon and Walnut and 6935 hectare area on agriculture crops, which was various cereal and vegetable crops are grown. Among the cereal crops, maize dominates during Kharif season whereas wheat and barley are the

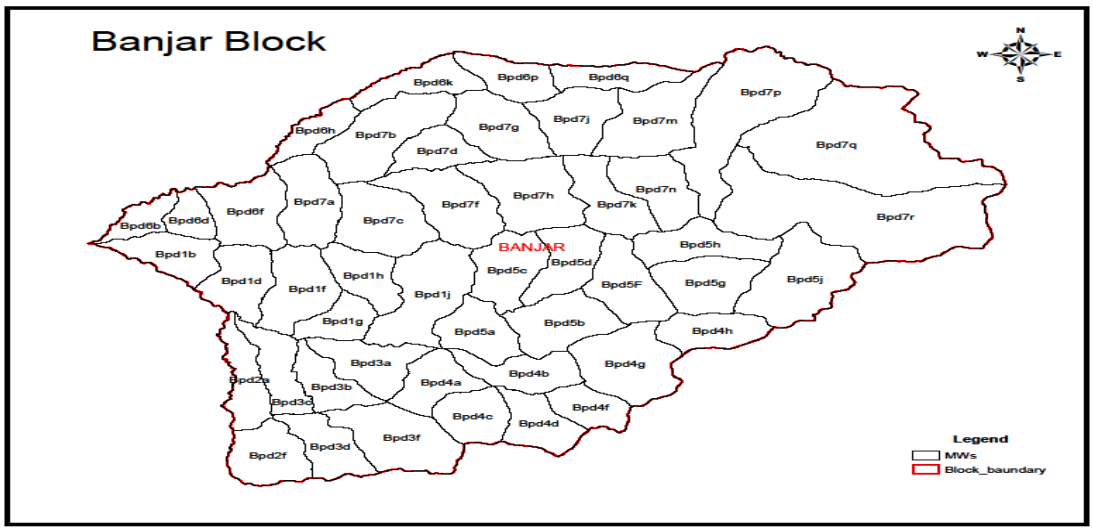

Fig. 1. Map showing MWs falling under CD Block Banjar: Latitude 31.638229° and longitude 77.344131°

main crops during Rabi season. Rajmash and Urd are also grown during the Kharif season. The vegetables are grown on 1360 ha (cropped) area in the Block. The most preferred vegetable crops are Peas, Garlic, Cauliflower and Cabbage. They are grown by 60.7, 45.6, 24.4 and 11.2% farmers, respectively. Nearly 26.4% farmers grow other types of vegetables. Interestingly, almost all the farmers preferred improved varieties of these crops. Mixed farming is the main stay of the farmers of the Block. Not only it provides the milk for home consumption as well as for sale but valuable FYM also becomes available which has sustained the farm economy over the centuries.

3. RESULTS AND DISCUSSION

The observed values of status of Horticultural Development in the block presented in Table (1), indicate that, the Apple accounted for 65.0 % among the fruit crops. Rest of the area was covered by other fruit crops. Almost all the farmers grew improved varieties of apple. About 74.2% of the farmers applied for FYM () and 55.6% farmers applied for chemical fertilizers, whereas, 65.9% used chemical pesticides. Approximately, 72.5% of the orchards were at bearing stage where as the remaining were at various stages of growth. Nearly 14.9% of the farmers were getting less than Rs 25000 per annum from the sale of fruits, 12.0% between Rs 25000 to Rs 49999, 8.9% between Rs 50000 to Rs 74999, 6.0% between Rs 75000 to Rs 99999 and 31.0% above Rs 100000. Maize accounted for 84.2 percent of the cropped area during Kharif season, whereas, wheat accounted for 82.2% of the cropped area during Rabi season. Majority of these farmers preferred to retain their own seed for cultivation. Most of the farmers (94.3%) used FYM for growing the crops. Only 2.0% farmers used pesticides, whereas, 94.6% farmers had marketable surplus of varying quantities and 44.7% of farmers earned less than Rs 5000 from their sale proceeds. However, 33.5% earned between Rs 5000 to Rs 9999, 10.3% between Rs 10000 to Rs 14999 and 5.7% earned above Rs 15000. Only 36.1% farmers had access to technical guidance (Table 2). Unlike cereal crops 23.2% farmers were having irrigation facilities for growing their crops, 69.9% farmers applied for FYM, whereas, 29.8% farmers used chemical fertilizers. About 50.7% farmers had marketable surplus out of which 43.3% earned more than Rs 15000, 22.1% between Rs 10000 to 14999, and 3.2% between Rs 5000 to 9999. Only 29.3% farmers had access to technical guidance (Table 3). It may be seen from the survey resultsthat 91.9% of the farmers had lactating cows, whereas, 53.3% farmers were rearing the improved breeds of the cows (Table 4). About 54.2% farmers earned more than Rs15000 from the sale of dairy products. Whereas 13.2% earned between Rs 10000 to Rs 14999, 21.2% between Rs 5000 to 9999 and 4.6 % below Rs.5000. Nearly 77.7% farmers did have access to technical guidance.

Table 1. Status of horticultural development in the block

1. Percentage of farmers growing apple	65.04
2. Percentage of farmers growing other fruits with apple	34.38
Percentage of farmers growing other fruits without apple	10.02
3. Percentage of farmers growing improved varieties of apple	64.46
Percentage of farmers growing local varieties of apple	0
4. Percentage of farmers having irrigation facilities	0
5. Percentage of farmers applying FYM	74.21
6. Percentage of farmers applying Chemical Fertilizers	55.58
7. Percentage of farmers applying pesticides	65.90
8. Percentage of farmers having the orchard in bearing stage	0
9. Percentage of farmers getting sale proceeds above:	14.89
Below Rs. 25,000/=	12.03
Rs. 25,000/= to Rs. 49999/=	8.88
Rs. 50,000/= to Rs. 74999/=	6.02
Rs. 75,000/= to Rs. 99999/=	31.23
Above Rs. 1,00,000/=	
10. Percentage of farmers getting Technical Guidance	54.72

Table 2. Status of agriculture development in the block

1. Percentage of farmers growing maize	84.24
2. Percentage of farmers growing improved varieties of maize	0
Percentage of farmers growing local varieties of maize	84.24
3. Percentage of farmers growing wheat	82.23
4. Percentage of farmers growing improved varieties of wheat	0
Percentage of farmers growing local varieties of wheat	82.23
5. Percentage of farmers growing paddy	2.00
6. Percentage of farmers growing improved varieties of paddy	1.43
Percentage of farmers growing local varieties of paddy	0.57
7. Percentage of farmers growing barley	32.95
8. Percentage of farmers growing improved varieties of barley	2.86
Percentage of farmers growing local varieties of barley	31.23
9. Percentage of farmers growing potato	4.87
10.Percentage of farmers growing improved varieties of potato	2.57
Percentage of farmers growing local varieties of potato	2.29
11. Percentage of farmers having irrigation facilities	0
12. Percentage of farmers applying FYM	94.26
13. Percentage of farmers applying Chemical Fertilizers	8.30
14. Percentage of farmers applying pesticides	2.00
15. Percentage of farmers having marketable surplus	94.55
16. Percentage of farmers getting sale proceeds above:	
Below Rs 5,000/=	44.69
Rs 5,000/= to Rs 9,999/=	33.52
Rs 10,000/= to Rs 14,999/=	10.31
Above Rs 15,000/=	5.73
17. Percentage of farmers getting Technical Guidance	36.10

Table 3. Status of vegetable crops cultivation in the block

1. Percentage of farmers growing cauliflower	24.35
2. Percentage of farmers growing improved varieties of cauliflower	24.35
Percentage of farmers growing local varieties of cauliflower	0
3. Percentage of farmers growing cabbage	11.17
4. Percentage of farmers growing improved varieties of cabbage	11.17
Percentage of farmers growing local varieties of cabbage	0
5. Percentage of farmers growing garlic	45.55
6. Percentage of farmers growing improved varieties of garlic	45.55
Percentage of farmers growing local varieties of garlic	0
7. Percentage of farmers growing peas	60.74
8. Percentage of farmers growing improved varieties of peas	60.74
Percentage of farmers growing local varieties of peas	0
9. Percentage of farmers growing others	26.36
10. Percentage of farmers growing improved varieties of others	26.36
Percentage of farmers growing local varieties of others	0
11. Percentage of farmers having irrigation facilities	23.20
12. Percentage of farmers applying FYM	69.91
13. Percentage of farmers applying Chemical Fertilizers	29.79
14. Percentage of farmers applying pesticides	30.37
15. Percentage of farmers having marketable surplus	50.71
16. Percentage of farmers getting sale proceeds above:	
Below Rs 5,000/=	0.57

Rs 5,000/= to Rs 9,999/=	3.15
Rs 10,000/= to Rs 14,999/=	22.06
Above Rs 15,000/=	43.26
17. Percentage of farmers getting Technical Guidance	29.51

Table 4. Status of animal husbandry development in the block

1. Percentage of farmers having lactating Cows	91.97
2. Percentage of farmers having improved breed of cows	53.27
Percentage of farmers having local breed of cows	49.53
3. Percentage of farmers practicing AI	80.37
Percentage of farmers practicing NS	16.82
4. Percentage of farmers using Stall Feeding	48.59
Percentage of farmers using grazing	0
Percentage of farmers using Both	0
5. Average consumption of Concentrate per head per day	3.54
6. Average number of Lactating days in respect of improved breed of cows	204.97
Average number of Lactating days in respect of Local breed of cows	184.31
7. Average milk yield for Improved cows (liters/day)	5.6
Average milk yield for Local cows (liters/day)	2.7
8. Percentage of farmers having lactating buffaloes	0
9. Percentage of farmers having sheep	17.47
10. Percentage of farmers having goats	3.72
11. Percentage of farmers having other livestock	92.83
12. Percentage of farmers getting sale proceeds above:	
Below Rs 5,000/=	4.58
Rs 5,000/= to Rs 9,999/=	21.20
Rs 10,000/= to Rs 14,999/=	13.18
Above Rs 15,000/=	54.15
13. Percentage of farmers getting Technical Guidance	77.65

Table 5. Improvement expenditure estimate in respect of C D block Banjar

Basic Statistics	
• No of MWs in the CD Block (44+ 5 Snow Bound) =	49 **
• Range of general slope of land	30 To 85 %**
• Farmers' owned land area	10858 Ha**
• Net sown area	6935 Ha
• Irrigated area	0.37 %**
• Area under Fruit Crops	7254 Ha
• Fodder supply against demand*(%)	
• Green fodder	Nil
• Dry fodder	42.4 %
Improvement Expenditure to be met from CAT Plan (Rs. In Lakhs)	
• Cost of 1.0 % additional area(69 Ha) to be brought under irrigation(@ Rs. 1.0 Lakh/ha)	69.00
• Cost of 1 % area(69 Ha) to be brought under organic farming (@ Rs. 10,000/= per ha)(Only incentive portion)***	6.90
Rejuvenation of senile orchards {1.0 % of area = 72 Ha) @ Rs.80,000/= per ha} (Only incentive portion)***	57.60
Area expansion under Hort. Crops {1.0 % of area(72 Ha) @ Rs.60,000/= per ha}(Only incentive portion)***	43.20
1.0 % of area (108 Ha) to be Bench Terraced (@ Rs.1,06,882/= per ha)****	115.43
• One Community Water Storage Tank for 10 hectare command area in each Block***	17.25
• One Farm Pond (125 CM) for each micro-watershed (44 Nos.)	130.24

	@ Rs. 2,96, 000/= per pond****	
•	1.0 % of farmers' owned land (108 Ha) to be brought under grassland improvement (@ Rs. 1.0 Lakh/ha)*****	108.00
•	Fodder cultivation****** i). Kharif fodder cultivation on 30 Ha @ Rs.19120/= per ha ii). Rabi fodder cultivation on 30 Ha @ Rs. 22800/= per ha	 5.73 6.84
•	One Natural Breeding Centre (NBC) in each micro-watershed (44 Nos.) @ Rs. 25,000/= per centre******	11.00
•	Cost of one Gosadan to accommodate 100 cattle heads 1. Recurring cost@ Rs.40/= per cattle per day 2. Recurreing cost of 4 attendants @ Rs. 120/=/per day/per attendant 3. Fixed cost for raising Gosadan structures	 14.60 1.73 5.00
Total		**592 52 lakh**

From the available data, it is quite evident that the CD Block has almost negligible area under irrigation which needs to be increased. The senile orchards are required to be rejuvenated. Additional area needs to be brought under fruit cultivation so that repeated cultivation leading to soil erosion are minimized. The steep slopes can be cut to form bench terraces to minimize soil loss. Since Animal Husbandry is an important enterprise of the farmers, therefore the fodder shortage (both green as well as dry) can be reduced by putting some cultivated area under green fodders and improving the existing Ghasnies [20-25]. The region receives good amount of rainfall but most of it is received during monsoon period extending from June to September. Most of it is lost as runoff taking along with it the fertile top soil. This excess water is to be stored in suitable water harvesting structures. Also, the menace of stray cattle is required to be tackled by providing at least one or two Gosadans in each CD Block.

A financial outlay to bring the above mentioned improvements on just one percent of area owned by the farmers has been given in the Table 5.

4. CONCLUSION

In summary, a sum of Rs.592.52 Lakh will be required to bring the desired improvement in the CD Block so as to improve the economy of the farmers at least partially and at the same time conserve the soil and water also so as to reduce the silt load of the river water system. From the complete analysis done so far, the following recommendation may be made:

1) Additional area may be brought under irrigation
2) From the area under field crops, efforts may be made to bring some area under fruit crops
3) Senile orchards may be rejuvenated and leguminous grasses like White clover or Red clover may be grown in between so as to improve the fodder quality as well as add nitrogen to the orchard soils.
4) Wherever agriculture is done on sloppy lands, bench terracing should be done.
5) Water harvesting structures may be raised
6) Some cultivated area be put under fodder cultivation
7) The Ghasnies may be improved by planting nutritious fodder species.Since the elevation of the catchment ranges from 350 meters to 3000 meters, all kind of grasses can be grown at different elevations as per their requirements. The grasslands can be dotted with useful fodder trees so as to make the green fodder available for a longer period.
8) In case of inaccessible areas, Natural Breeding centers (NBCs) be established
9) The areas which are neither suitable for field crops nor for fruit crops should better be put under forest cover.

On the above survey data were concluded that, a total sum of Rs 592.52 lacs will be required to bring the desired improvement in the economy of farmers at least partially and conserve the soil and water to reduce the silt load of the river water system in near future.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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