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Impact of improved backyard production system on livelihood empowerment

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ABSTRACT

The study was attempted to assess the impact of viable backyard based technological interventions on rural livelihood empowerment to the farmers of four selected disadvantaged districts, viz. Uttar Dinajpur, Dakshin Dinajpur, Malda and Murshidabad of West Bengal as a part of National Agricultural Innovation Project. The participatory and personal interview methods were followed to collect the information. The performance of the technological interventions was studied by following "Before-After" design. The results showed positive change in favour of livelihood empowerment. The vermicomposting technology showed net annual return to the tune of more than ` 9000.00. The small multi-tier horticulture technology meets the needs of the households' nutritional requirement (99.24% per capita increase of vegetable consumption) and also increases the annual income up to 4 times. The performance improvement in case backyard production of goatery, poultry and duckery also helps in improving and sustaining the livelihood status of the beneficiaries. Increase of annual income to the tune of 130.59% from goatery, 88.17% from poultry and duckery holds good for sustaining the livelihood of landless people in the project area. The aquatic niche is managed through the technologies like extensive composite fishery, air breathing fish culture in unutilized derelict ditches and pond dyke based intensive small horticulture cum fodder cultivation led to 46.39% av. increase in fish yield, 62.11% av. increase in annual egg productivity. Briefly, improved backyard production system found to be a distinctive action oriented rural development strategy in view of social and economic aspects.

***Keywords*:** Empowerment, horticulture, livelihood, management, nutritional security

In the changed global scenario, for the very purpose of attaining rural livelihood empowerment across the whole of the state, there has to be appropriate technology intermediation in weaker section of the community. Livelihood empowerment has to be a sequenced approach for livelihood provisioning, livelihood protection and livelihood promotion in a fashion so as to provide the target communities' greater access to natural, physical, social, human and financial capital and assets and livelihoods can be improved through action research based technology support. Numerous authors (Chambers 1989; Maxwell and Smith 1992; Frankenberger and Coyle 1993) note that food security is but one element of livelihood security. Bagchi *et al*. (1998) use the term - livelihood trajectories to describe and explain the direction and pattern of livelihoods of individuals or groups of people (for example, households). The concept of sustainable development is social, rather than fundamentally scientific. It relates to the management of natural resources for human purpose and is therefore opened to different interpretation (Tait and Morris, 2000). On the other hand, the share of workforce engaged in agriculture, which was about 70 per cent in 1951, is still more than 50 per cent. This has led to widening of gap between incomes in agricultural and non-agricultural sectors, and this is perceived to be one of the major reasons for the persistence of poverty in the country (Kumar *et al*., 2011). Many studies have highlighted the role of off-farm sector in providing employment and improving income and standard of living of rural population (Kumar *et al*., 2003; Bhakar *et al*., 2007), while some have observed farming to be still a major source of income (Rawal *et al*., 2008). Backyard chicken production is a subsistence activity, providing eggs and meat for family consumption and, to some extent, cash income (Debnath *et al*., 2011). Therefore to attain equitable targeted growth across a nation, there has to be appropriate technology intermediation in the weaker areas of livelihood practices— land-based, homestead-based as well as off-farm-based. It is more in the state of West Bengal where the status of material and human development has strong regional dimensions, more than other parts of the country. Thus, the present study under the sub-project of NAIP, Component-III, envisaged homestead and allied non–farm based livelihood systems to identify, validate and assimilate target groups-specific technology options for increased productivity and profitability and to create a sustainable institutional platform to link stakeholders. The enhanced livelihood in backyard production system was observed through intermediation of the year round small horticulture, backyard poultry, backyard

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goatery, vermicomposting, extensive composite fishery, air breathing fish culture in unutilized derelict ditches and Pond dyke based horticulture simultaneously with fodder production. In different aspects the project has initiated several capacity building programmes for the beneficiaries throughout the project period towards the improvement of the livelihood status. Keeping in view of the above, the objective of the study was to assess the efficacy of the introduced technologies under homestead and backyard production system in enhancement of rural livelihood standard lead to sustainable livelihood security and empowerment.

MATERIALS AND METHODS

The study was conducted in four disadvantaged districts, namely Uttar Dinajpur, Dakshin Dinajpur, Malda and Murshidabad of West Bengal which were brought under Sustainable Livelihood Empowerment sub-project of National Agricultural Innovation Project (NAIP). The study was based on primary research data for the period from 2008 to March, 2014, collected through field programmes from 1314 respondents of NAIP–3 was operated from 2008 to 2014. In this study the target groups are small and marginal farmers, rural wage labourers / land less, fish farmers, rural artisans, small entrepreneurs, farm women, tribal and other socially excluded groups, small holder livestock farmers, small entrepreneurs, self–help groups. The sample units were scattered over ten villages of Itahar, Tapan, Manickchalk and Suti-I blocks of Uttar Dinajpur, Dakshin Dinajpur, Malda and Murshidabad districts respectively. Data were collected using a well structured questionnaire and were triangulated by the PRA tools and interview results. The primary data, collected during over five years were analysed using tabular and percentage methods.

RESULTS AND DISCUSSION

Considering very poor land base of participating community partners and scant consumption of vegetables (131gm caput^{-1}day^{-1}) in daily diet, enhancement of household nutritional security through women led multi-tier horticulture under homestead based backyard/ courtyard/pond dyke production situations was introduced. The concerned technology was having two core components: i. positioning of very low cost three tier scaffolds for more utilization of vertical space. ii. Round the year growing of miscellaneous seasonal vegetables. Standardization of scaffold structure was done through participatory refinement of the prototype especially to ensure availability of sunshine at all the tiers. At the base of tier (*i.e*. on the ground), crops like chilli/hybrid tomato/veg. coriander/ green fenugreek/ red amaranthus etc. were placed. At tier-1 (i.e. over 4' wide scaffold) broad leaved cucurbitaceous crops like bottle gourd/cucumber/ash gourd/ridge gourd etc. were grown at tier-2 (*i.e*. over 2' wide roof of the scaffold), short leaved vine crops like bitter gourd / *basella* etc were taken. Performance improvement of backyard production situation was also inclusive of backyard goatery, poultry and duckery.

The increased performance of women led backyard production system is highlighted in table 1 and also the structural cost in table- 2. The table- 1 and 2 revealed that with the average annual cost of multi-tier vegetables production over 720 sq. ft area (1 *katha*) being around ‘446.00, the technology could evoke huge response to 99.24% per capita increase of vegetable consumption in daily diet from 131gm caput^{-1}day^{-1} at base level to that of 261 gm caput^{-1}day^{-1} by the beneficiaries at the cluster levels.

Table 1: Increased performance of women led backyard production systems

Parameters	Baseline	Present	% gain
Homestead horticulture			
Av. vegetable produce taken homestead^{-1} unit (kg wk^{-1})	6.1	14.37	135.57
Av. per caput rate of veg. consumption in daily diet (g)	131	261	99.24
Av. quantum of marketed veg. produces homestead^{-1} (kg annum^{-1})	134	251	97.31
Av. economic value of marketed veg. produce homestead^{-1} (‘ annum^{-1})	1176	4913	317.77
Backyard goatery			
Mean annual weight gain animal^{-1} (kg annum^{-1})	4.23	7.80	84.40
Mean kidding habit of animals cycle^{-1} (no.)	1.45 kids	2.7 kids	86.21
Av. economic value of marketed animal homestead^{-1} (‘ annum^{-1})	1870.00	4312.00	130.59
Av. no. of unsold stock homestead^{-1}	-	4.82	-
Backyard poultry or duckery			
Av. no. of eggs homestead^{-1} annum^{-1}	110/95	173/154	57.27 / 62.5
Av. economic value of marketed produce homestead^{-1} (‘ annum^{-1})	1251	2354.00	88.17

On the other hand, it was also reported that there have been significant gains in both average weekly harvests (135.57%) and average quantum of annually marketed vegetables (97.31%) by each participating households leading to accrual of around 4.17 times additional income per household from the corresponding baseline value of a meager ‘1176 per annum.

Table 2: Estimated structural cost of multi-tier horticulture (scaffold)

Item	Quantity	App. rate (`)	Amount (`)
Bamboo (pc)	5.2 pc × 35' length	70.00	364.00
Nylon thread (g)	200	0.18	36.00
Nails and wire (g)	500	0.05	25.00
Labour charge (No.)	3	88.00	264.00
		Total Cost =	**689.00**

Specified size: Tier-1: 62' X 4' = 248 sq. ft, Tier-2: 66' X 2' = 132 sq. ft
Total size: 380 sq. ft
Cost sq. ft^{-1}.: `689.00/ 380 sq. ft = `1.81
Cost $Katha^{-1}$ (720 sq. ft.): `1303.20 (Say `1303.00
Cost of seed and nutrients *katha*$^{-1}$ (LS): `120.00
Total cost (1+2): `1303+`120 = `1423.00
The scaffold materials can be used for four consecutive years.
Cost of production of multi-tier vegetables for *3 years* = `1303+ (120X4) = `1783.00
The average annual cost of multi-tier vegetables production = `445.75

Performance improvement of backyard production situations was also inclusive of backyard goatery (Breed: Bengal goat) and poultry (Fowl Breed: Gramapriya, Duck Breed: Khaki Campbell) to cause average annual income increase by 130.59% from goatery as a micro enterprise, as well as 57.72% and 62.50% increase in average annual egg productivity from backyard poultry and duckery respectively led to gain 88.17% economic return from marketed produce per unit. The study of Debnath *et al.* (2011) also indicated that hens lay an average of 17 eggs per month with an annual production varying from less than 180 to 212 per year for improved breed led to increase family income.

Vermicompost was one of the important backyard based women group focused income generating activity at cluster areas. It is also one of the effective recycling in local homestead horticultural production cycle. The economic analysis from vermicompost pit is presented in table- 3 and also the estimated structural cost of vermicompost unit which was standardized at the cluster levels by considering the local available resources as well as financial capacity of the farmers delineated in table- 4. The table-3 indicated that total production and net return from vermicompost pit has increased over the years which indicated that farmers are more interested to produce and used this product to their field in place of chemical fertilizers. The average net return from vermicomposting was ‘8325.52 pit^{-1} $year^{1}$ with B:C of 1.39:1.

Table 3: Economic analysis of cottage scale vermicompost enterprise

Year	No. beneficiary involved	No. of unit	Total production $year^{-1}$ (to)	Cost $unit^{-1}$ $year$ (`)	Net return $unit^{-1}$ $year^{-1}$	B:C
2008-09	90	10	25.08	5266.80	7524.00	1.43:1
2009-10	172	18	45.55	5693.75	7591.67	1.33:1
2010-11	242	25	61.21	5704.77	7761.43	1.36:1
2011-12	324	37	95.55	6068.72	8909.39	1.47:1
2012-13	432	45	113.45	6302.78	8823.89	1.40:1
2013-14	484	50	124.57	6851.35	9342.75	1.36:1
Average	**-**	**-**	**-**	**5981.36**	**8325.52**	**1.39:1**

Under aquatic niche management extensive composite fishery**, a**ir breathing fish culture in unutilized derelict ditches (size 20 decimal), pond dyke based intensive small horticulture cum fodder cultivation had been introduced in our cluster areas. The technology concern extensive composite fish culture of Indian carp species in the ratio of Katla: Rohu: Mrigal = 4:3:3 with water analysis based supplement feeding

For integration of duckery with the aquatic niches, Khaki Campbell breed in 5:25 male-female ratio was introduced and the bamboo fabricated 150 ft^2 concerned housing structure was constructed in a hanging position by using bamboo poles to allow the excreta to fall in the water bodies.

Intensive pond dyke based small horticulture and fodder production consisted block wise cultivation of miscellaneous seasonal vegetables like onion, chili, hybrid tomato, pumpkin, spinach and veg. coriander as per choice and hybrid napier or berseem. Alongside, and for the purpose of more intensive use of available space, arial cultivation using scaffolds was put in practice for growing bottle gourd, ridge gourd, ash gourd, snake gourd and bitter gourd as per choice and seasonal compatibility.

Table 4: Estimated structural cost of vermicompost unit (250 kg capacity $month^{-1}$)

Item	Quantity	Rate (`)	Amount (')
Bamboo	12 pc × 35' length	75.00 pc^{-1}	900.00
Earthing of the floor	15' × 9' × 1'= 135 cft	1.20 cft^{-1}	162.00
Bricks for vermi -bed	45 bricks bed^{-1} × 2 = 90	5.00 $brick^{-1}$	450.00
Straw for roof	1000 Bunch	0.40 $bunch^{-1}$	400.00
Nylon net	500 g	130.00 kg^{-1}	65.00
Polythene sheet	500 g	180.00 kg^{-1}	90.00
Darma	120 sq. ft.	3.75 ft^{-2}	450.00
Jute rope	500 g	100.00 kg^{-1}	50.00
Nail	LS		50.00
Labour charge	2 skilled and 3 unskilled	150.00 &120.00	660.00
Total =			**3217.00**

The economic analysis of aquatic niche management was presented in table- 5. From the table, it was noticeable that both productivity as well as av. value of marketed produce has been increased for extensive composite fishery as well as duckery at the cluster areas. The table- 5 showed that extensive composite fishery and small scale duckery led to 46.39% av. increase in fish yield, 62.11% av. increase in annual egg productivity respectively as well as av. monthly accrual of 82 kg miscellaneous horticultural and fodder produces per family.

Table 5: An economic analysis of aquatic niche management

Particulars	Baseline	Present	% gain
Extensive composite fishery			
Productivity (t ha^{-1})	0.97	1.42	46.39
Av. value of marketed produce (` ha^{-1})	116400	180000	54.64
Air breathing fish culture in derelict ditches			
Productivity (t ha^{-1})	-	1.07	-
Av. mean weight gain by the stock (g $month^{-1}$)	-	23.52	-
Av. value of marketed produce/ditch (Av. unit size 20 decimal)	-	9361	-
Duckery			
Av. no. of eggs $unit^{-1}$ $annum^{-1}$	95	154	62.11
Av. value of marketed produce $unit^{-1}$ $annum^{-1}$ (`)	1251	2331	86.33
Pond dyke based horticulture + fodder production			
Av. quantum of production $unit^{-1}$ $month^{-1}$	-	82 kg	-
Av. economic value of marketed produce/ unit (`$annum^{-1}$)	-	2300	-

In view of limited available natural resources and sub-marginal size of land holding based on utilization of homestead areas simultaneously with off-farm livestock raising, particularly the women led introduction of innovative multi-tier scaffolds for year round horticulture through intensive utilization of available backyard or courtyard spaces as a short term negotiation tool, backyard goatery, backyard poultry, vermicompostring in group approach and composite fishery along with air breathing fish culture, duckery and pond dyke based horticulture and fodder production under aquatic niche management might be the important livelihood approaches for income enhancement and safeguard to maintain the nutritional security to empower the livelihood standard of the marginal household particularly women folk of rural areas.

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