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Research Note

Nutri-garden for Sustainable Food Security and Nutritional Diversity in Hamirpur District of Bundelkhand Region (U.P.)

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ABSTRACT

Nutri-garden is one of the easiest ways of ensuring access to a healthy diet that contains adequate macro and micronutrients. Thus the study were planned keeping in view improved food security, increased availability of vegetables, better nutrition and food diversity by provisioning bio-fortified vegetable varieties seeds and saplings. The purposive experimental study was planned. The study was conducted in 12 villages under FLDs programme in Hamirpur District. Total 120 farm families were selected for the study having area around 150 m^2 near the house. Total 33 varieties were provided throughout the year in every *Nutri-garden*. Brocalli, Pusa Chaulai, Sarson Saag, and Kasuri Menthi etc. (rich source of nutrients) were first time introduced in selected Nutri-Garden. It was found that area available for kitchen garden in most of farm families was cultivated area near the house (29.17%) and unused land near the house (35.83%). It was observed that maximum production was in Rabi season followed by Kharif and Zaid season respectively, may be due to scarcity of water in Bundelkhand region during summer. Availability of Macro and micro nutrients through consumption of vegetables in daily routine diet was found satisfactory.

Keywords*:* Food security, Nutritional diversity, Malnutrition, Mitigation, Nutri-garden

INTRODUCTION

The global population is growing at a rapid rate and is expected to reach over 9 billion by 2050. The need to feed the continually growing population is crucial. It has been projected that average daily energy need could reach 3050 kcal per person by 2050 requiring global food production to increase by 70 per cent. Among all people, those of developing countries are suffering from chronic food insecurity at a higher rate than others (FAO, 2014). Now a days India is suffering from triple burden of widespread poverty, food insecurity and under-nutrition. India is likely to be the most populous country by 2030 with 1.6 billion people with a vast majority of hungry and malnourished people. Over half of the population suffers from chronic food insecurity. It has been projected that global food production will need to increase by 70 per cent in order to meet the average daily calorie requirement of the world's population in 2050s. The household level data on calorie intake indicates that the average calorie consumption among population in India is falling over the last twenty years. Common nutritional problems of human beings are protein energy malnutrition (PEM), micro nutrient deficiencies like vitamin A deficiency (VAD), Iron deficiency anaemia (IDA), Iodine deficiency disorder (IDD) and Vitamin B complex deficiencies**.** The expert committee of Indian Council of Medical Research (ICMR-2012) recommends that every individual should consume at least 300 g vegetables and 100 g fresh fruits /day (green leafy vegetables – 50 g, other vegetables 200 g, roots and tubers -50 g) and pregnant women should consume 100 g leaf vegetables/day.

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In India per capita availability is around 135 g against the minimum requirement of about 300g for a balance diet. Even this low level of average supply does not fully reflect the consumption pattern of the rural household and those below the poverty line where per capita vegetable consumption is very low, even lower than 40g per day. It is now well conceived that by simply adding greens and other vegetables to the available food grains the diet of the average Indians can substantially be upgraded. To make this recommendation realistic promotion of Nutri-garden is the best option which can supply required vegetables in daily diet to the rural families. Bundelkhand region many semi-arid and arid areas particularly exposed to the impacts of climate change and projected to suffer a decrease of water resources. Very less farmers were growing vegetables in all season for household consumption. So that lots of population suffering from malnutrition problems. In rural areas surroundings of house some unused land are vacant which can be utilize for installing "Kitchen Garden" which will produce fresh vegetables for supplementing the vitamin deficiencies of the human population. In addition, extra produce will add to additional income by sale of the vegetables in the market, thus they can increase the earnings of the family. Hence, Nutri-garden is a realistic solution to solve the nutritional insecurity in this region. The intervention based study was planned in rural areas of Hamirpur district in Bundelkhand to enhance nutrition knowledge of rural women, ensure fresh and nutri-rich vegetables in daily routine diet by providing Bio-fortified variety's seed and saplings of vegetables so that consumption as per RDA of ICMR for healthy life may be ensured.

METHODOLOGY

The study was conducted purposely in 12 villages of different blocks (Kurara, Sumerpur, Rath, Sarila, Gohand, Muskara) under FLD Programme by Krishi Vigyan Kendra, Hamirpur. Ten farm families were selected from each village making a total of 120 farm families having 150 m^2 area near around the house for interventions. Data was collected through a well-developed interview schedule to elicit information from selected households. A plan for model of nutri-garden of 150 m^2 was drawn up (Figure 1), keeping in view the maximum output and a continuous supply of vegetable for the table throughout the year as per recommended by ICMR (Indian Council of Medical Research) 2010.

To fulfil the daily requirement of vegetables in diet as per recommended by ICMR 2010, provided Kitchen garden kit of Bio-fortified variety of vegetables seeds and saplings in Kharif, Rabi and Zaid season. Kitchen garden kit was purchased from IARI, New Delhi and

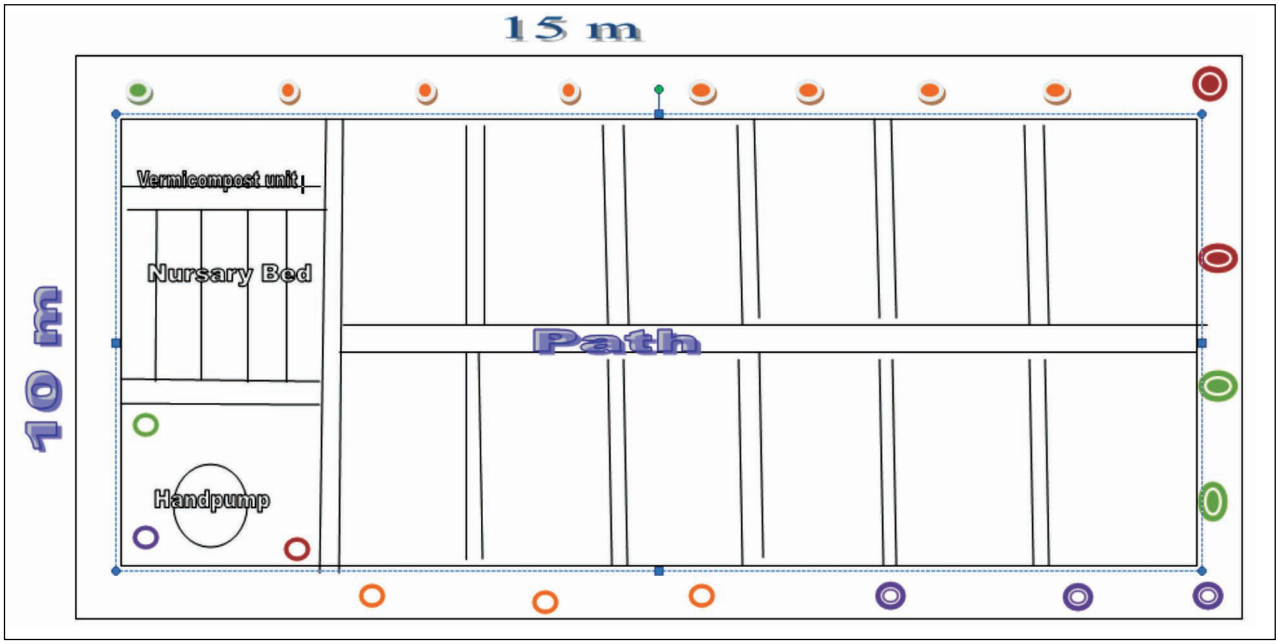

Figure 1: Layout of Model Nutri garden

IIVR, Varanasi (U.P.). The data regarding area available for nutri-garden, vegetable grown in different season, yield and consumption pattern were collected on weekly basis from selected households. Simple descriptive statistics was employed in order to have a summary description of the data collected.

RESULTS AND DISCUSSION

The area that got cultivated for kitchen gardening, the choice of vegetable crop grown was entirely depends on food preference of the respective family. Pal and Kaur (2019) reported that non-availability of quality planting material of fruits and seeds of HYVs of vegetable, lack of knowledge about improved varieties, seed rate and sowing time, lack of knowledge about seed treatment and lack of knowledge were reported major bottlenecks in successful adoption of kitchen gardening.

Table 1 depicts that area available for kitchen garden in most of farm families was unused land near the house (35.83%) followed by in cultivated area near the house (29.17%) and cultivated area near the tube well (20.00%). Only 15 percent farm family's court yard for Nutri-garden was available in Hamirpur district. It was also found that most of the respondents has not grown all types of vegetables throughout the year before intervention of this programme due to lack of awareness, laziness and lack of seed. Kaur *et al.* (2017) also found that 47 per cent respondents cultivated vegetables, pulses and fruits for their nutritional garden. However, Pal and Kaur (2019) reported that non - availability of quality planting material of fruits and seeds of HYVs of vegetable, lack of knowledge about improved varieties, seed rate and sowing time, lack of knowledge about seed treatment and lack of knowledge were reported major bottlenecks in successful adoption of kitchen gardening.

A seasonal calendar of locally available all types vegetables viz. Green leafy vegetables, root and tuber, fruits and other vegetables was prepared. The Kitchen garden kits were prepared by purchasing of Bio fortified variety of vegetables seeds**.** The saplings of naturally fortified fruits like - Moringa, Curry leaf were also made available to selected households.

Table 2 depicts that around 33 nutrient-rich varieties of vegetables were grown throughout the year in every nuri-garden. Data reveals that maximum production (337.98 kg) was found for fruits and other vegetables, followed by green leafy vegetables (144.61 kg), and root and tuber crops (108.18 kg). Total production was 590.77 kg in the year. Brocalli, Pusa Chaulai, Sarson Saag and Kasuri Menthi etc. were first time introduced in selected kitchen garden of Hamirpur. Promotion of all types of vegetables was emphasized for their nutritional importance and diversification.

The results indicated that according to season, the quantity of vegetables produced per household was highest in Rabi season whereas lowest in Zaid season due to scarcity of water during summer in Bundelkhand region. Study also get supported from Aliza *et al*. (2018). It was found that 150 m^2 area of kitchen garden fulfilled more than the requirement of vegetable in daily routine diet for family (Up to 6 Members) in Rabi season followed by 76.30 per cent in *Kharif* season and 67.64 per cent in *Zaid* season. The average net income saved by the

Table 1: Distribution of respondents on the basis of availability of area and vegetables grown before intervention (N= 120)

Area Available	No. of respon-dents / %	No. of respondents grown before intervention		No. of respondents grown vegetables in different season before intervention								
				Kharif			*Rabi*			*Zaid*		
		Yes	No	GLVs	F/R	All	GLVs	F/R	All	GLVs	F/R	All
Backyard/ Court yard of house	18 (15.00)	13	05	-	13	-	03	09	01	01	04	-
Unused land near the house	43 (35.83)	27	16	01	24	02	04	20	03	03	09	-
Cultivated areas near the house	35(29.17)	29	06	01	27	01	06	21	02	06	10	-
Cultivated area near the tube well	24(20.00)	19	05	03	15	01	03	12	04	05	07	01

Table 2: Promotion of Bio-fortified Vegetables for Nutritional Diversity

Type of vegetables	Name of Vegetables/Variety	Production in different seasons			Total
		Kharif	*Rabi*	*Zaid*	
Green Leafy Vegetable	Palak (All Green)	10.11	16.47	11.78	38.36
	Chaolai (Pusa lal chaulai)	10.90	10.57	10.85	32.32
	Coriander (Vardaan)	1.14	6.51	1.73	9.38
	Methi (Pusa Kasuri)	0	12.82	0	12.82
	Sarson Saag (Pusa Sarson Saag1)	0	12.82	0	12.82
	Chenopodium album (Bathua)	0	5.28	0	5.28
	Cabbage (Pusa Mukta)	0	18.07	0	18.07
	Brocalli (KTS-1)	0	15.56	0	15.56
Fruit vegetables	Tomato (Kashi Aman)	0	24.95	0	24.95
	Cauliflower (Pusa Shrad)	0	18.98	0	18.98
	Brinjal (Kashi Sandesh)	0	21.18	0	21.18
	Bottle gourd (Kashi Ganga)	24.88	0	16.83	41.71
	Chilli (Kashi Anmol)	0	5.12	0	5.12
	Pumpkin (Kashi Harit)	27.37	0	15.59	42.96
	Sponge gourd (Kashi Dibya)	18.60	0	12.30	30.9
	Nasdaar tori (Kashi Shivani)	21.56	0	0	21.56
	Sarputiya (Kashi Khushi)	6.93	0	0	6.93
	Bitter gourd (Pusa do Mausami)	5.42	0	8.79	14.21
	Cucumber (Pusa Sanyog)	6.58	0	8.94	15.52
	Snake Guard	9.90	0	0	9.9
	Lady's Finger (Kashi Pragati)	13.14	0	12.35	25.49
	Cucumis Melo (Kakdi)	0	0	7.74	7.74
Beans	Red kidney bean (Rajama)	0	5.28	0	5.28
	Pea (Kashi Udai)	0	14.80	0	14.8
	Sem (Kashi Haritima)	0	0	16.83	16.83
	Cow pea (Kashi Kanchan)	0	0	13.89	13.89
Root and Tuber	Knol khal	0	12.82	0	12.83
	Radish (Pusa Shweta)	10.56	17.59	8.50	36.65
	Carrot (Pusa Rudhira)	0	15.48	0	15.48
	Garlic (Yamuna Sefed)	0	7.38	0	7.38
	Onion (Agrifound Dark Red)	0	8.84	0	8.84
	Turnip (Pusa Shweti)	0	16.56	0	16.56
	Beetroot (Detroit Dark Red)	0	10.44	0	10.44
	Total Production	167.10	277.56	146.11	590.77

Table 3: Evaluation of availability of vegetables round the year through Kitchen Garden (area 150 m^2)

Season	Average No. of family member	Reqt. of Vegetables Throughout the year (kg)	Availability of vegetable (kg)	Gap/ Difference (kg)	Reqt. Fulfilled (%)	Cost of cultivation (Rs.)	Gross Income (Rs.)	Net Income (Rs.)	B:C Ratio
Kharif (122 Days)	06	219.60	167.10	-43.50	76.30	680.0	3625.88	2945.88	1:5.3
Rabi (123 Days)	06	221.40	277.56	+56.16	125.36	880.00	5787.40	4907.40	1:6.6
Zaid (120 Days)	06	216.00	146.11	-69.89	67.64	980.00	3883.20	2903.20	1:3.9
Throughout the year	06	657.00	590.77	66.23	89.92	2540.00	13296.48	10756.48	1:5.3

Source: ICMR 2012-Guidelines for Indian, Requirement of Vegetables/day/person 300 g

farmer was Rs. 10756.48 per year from the kitchen garden. Similarly, Kumari *et al.* (2018) reported that from 150 m^2 (for Small Family 5 Members) of kitchen garden 100 per cent requirement of vegetable in daily routine diet was fulfilled and saved the money for buying other vegetables.

Nutritional value index for all 33 varieties of vegetables grown in nutrition gardens across the three seasons were calculated with the help of ICMR 2012 methodology. Table 4. depicts that the availability of green leafy vegetables was found more i.e. (66.03 g/person/ day) and vegetables was found less (154.32 g/person/ day) as compared to recommendations of ICMR 2010. The availability of macro and micro nutrients was also found sufficient in diet as per National Institute of Nutrition, Indian Council of Medical Research (ICMR 2018) recommended minimum requirements of Protein (20.0 g) from cereals, 21.0 g from pulses,10 gm from milk, 4.0 g from vegetables, 1.0 g fruits and 4.0 gm from nuts & seeds per person /day for healthy life.

Consumption pattern of vegetables before and after introducing Kitchen garden was calculated. It can inferred from Figure 2 that average vegetable consumption of a person was less than RDA before introducing kitchen garden and also consumption of green leafy vegetables, root and tuber was very less as compare to other vegetables may be due to awareness.

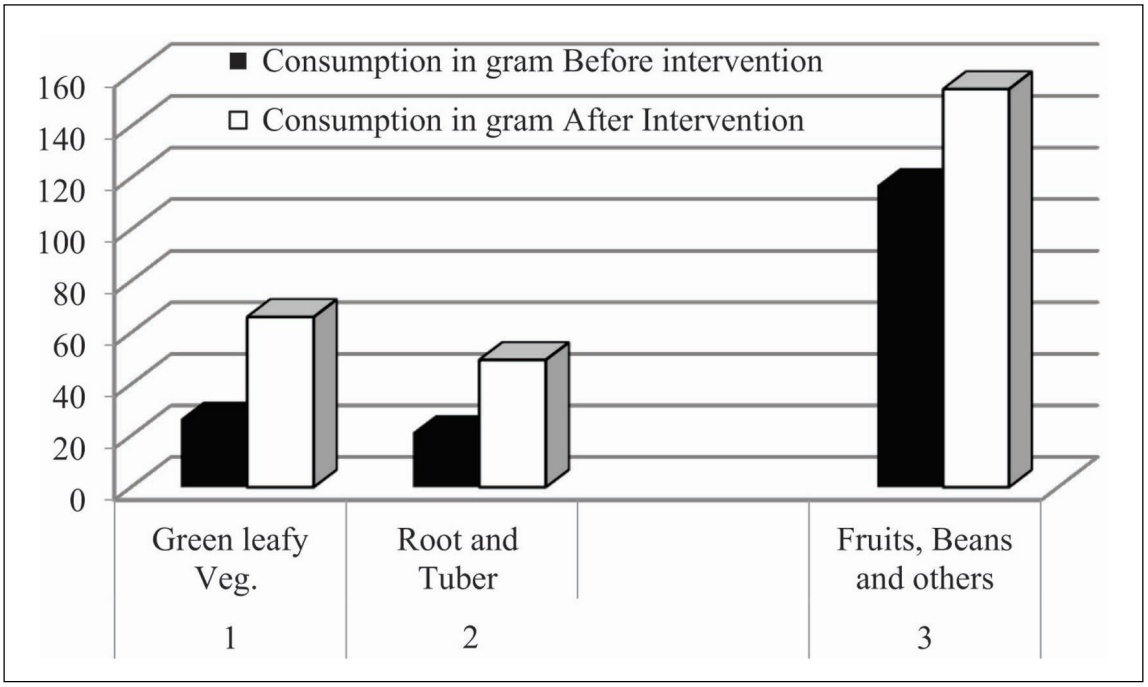

Figure 2: Consumption pattern of vegetables

Table 4: Nutritional Requirement fulfilled of Vegetable through Kitchen Garden in Selected Farm Families

Model of Kitchen Garden	Average No. of family member	Requirement /Availability of types of vegetables /day/ person (g)	Requirement / availability of types of vegetable throughout the year (kg)	Nutritional Requirement fulfilled / Person/ day									
				Energy (Kcal)	Protein (g)	Fat (g)	CHO (g)	Fiber (g)	Vit. A (µg)	Vit C (mg)	Thimin (mg)	Raibo-flavin (mg)	Iron (mg)
(150 m^2)	06	Green leafy Veg. 50 g / 66.03	109.50/144.61	42	2.7	0.3	2.7	0.9	978	9.8	0.02	0.16	2.79
		Root and Tuber 50g / 49.40	109.50/108.18	28	0.9	0.1	5.2	0.7	543	8.0	0.03	0.03	0.81
		Fruits and Beans 200g / 154.32	438.00/337.98	76	1.8	0.4	12.4	3.2	126	18.7	0.12	0.12	1.7
Throughout the year		300g/269.75	657.00/590.77	146	4.4	0.8	34.6	3.8	1547	36.5	0.17	0.31	5.3

Source: Gopalan *et al.* ICMR 2012- Nutritive value of Indian Foods. pp-42.

As an impact of kitchen gardening on rural communities the consumption of all types of vegetables increased in daily diet. It was acknowledged that after intervention of kitchen garden all the participants were taking more interest and people saved money. Consumption of fresh and organic vegetables in daily routine diet also increased. Consumption of vegetables increase from 53 to 87 per cent, similar increase after the kitchen gardening training was reported by Galhena *et al.* (2013.)

CONCLUSION

It may be concluded that before intervention of technology of nutri-garden the farmers/farm women were not aware and also used inadequate quantity of vegetables in daily routine diet whereas after interventions of refined technology the production of vegetables increased as well as consumption of vegetables in daily. There are lots of social benefits that have emerged from kitchen gardening practices; better health and nutrition, increased income, employment, food security within the household and enhance in community social life. Increased consumption of fruits and vegetables is one of the easiest and cheapest ways of enhancing health. As such backyard nutrition gardening as a low cost sustainable approach for mitigating malnutrition especially in rural households need to be promoted at large scale.

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