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POPULAR ARTICLE



## Nutritional garden: An approach of nutritional security for farm households

Manisha Choudhary<sup>1\*</sup>, Chanchala Rani Patel<sup>2</sup> and S. P. Singh<sup>3</sup>

<sup>1</sup>Krishi Vigyan Kendra, Raigarh-496001(C.G.)

<sup>2,3</sup>Krishi Vigyan Kendra, Bilaspur-495001(C.G.)

Indira Gandhi Krishi Viswavidyalaya, Raipur (C.G.), India

\*Corresponding author: [spsinghsahab@gmail.com](mailto:spsinghsahab@gmail.com)

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India is one of the leading country in vegetable production but malnutrition problem especially caused by micronutrient deficiencies are in general family diet. The underlying cause may be lack awareness, illiteracy, low affordability, inadequate availability of vegetables and fruits. Recommended dietary allowances (RDA), daily intake of vegetables should be 300 gm/person including roots and tubers, green leafy and other vegetables. Malnutrition is a serious nutritional problem, resulting in different types of diseases, hampering physical growth and retarding brain development. Nutritional garden practices with strict adherence to sustainable technologies will be an everlasting solution. It ensures balanced household consumption of vegetables and fruits in their daily food habits and prevents nutritional maladies. The underutilized backyards of landless women not only serve the entire family with nutritious food but also get alternate livelihood. Homestead production of vegetables and fruits help combat malnutrition and diversify diets. Improved nutritional garden is better than traditional homestead garden. The improved nutritional garden involves many crops that can be repeatedly harvested to meet a family's vegetable needs and economic return. Hence, nutritional garden is an important strategy to improve household nutritional security. The nutritional garden has proved a feasible livelihood strategy for resource poor farm households and improvement in availability of vegetables for consumption in terms of nutrient as well as calorie intake and economic performances

**Keywords:** Nutritional garden, nutritional security, farm households,

## Introduction

Nutritional garden are in culture since ancient times and are growing vegetables, fruits, and other food crops in underutilized backyards of landless farm households not only serve the entire family with nutritious food but also get alternate livelihood. Production of vegetables in the world was almost 1010 million tons (FAO, 2011). Asia produces and consumes more than 70% of the world's vegetables. China has always been a large contributor and currently produces over 50% of the world's vegetables. India is the second largest producer of vegetables in the world but at almost a six-fold lower level than China. Worldwide the area of arable land devoted to vegetables is expanding at 2.8% annually, higher than fruits (1.75%), oil crops (1.47%), root crops (0.44%) and pulses (0.39%) and at the expense of cereals (-0.45%) and fibre crops (-1.82%) (FAO, 2009). Leafy vegetables - of which the leaves or young leafy shoots are consumed-were the most often utilized (53% of the total), followed by fruit vegetables (15%), while vegetables with belowground edible organs comprised 17%. Many vegetable crops have more than one part used. Homestead production of vegetables, fruits, spices, medicinal and aromatic plants help combat malnutrition, diversify diets and are boon to mankind in several ways. Vegetables are major source of vitamins, minerals, and fibers; their nutritive and medicinal values in human beings. Indian Council of Medical Research (ICMR) recommendations 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 ). Pregnant women should consume 100 g leaf vegetables/day. Several 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. Nutritional garden can be a profitable proposition in India which is predominantly vegetarian and, as such, a large number of nutrients are obtained from vegetables for a balanced diet. Due to inadequate consumption of vegetables, deficiency of micro-nutrients especially of iron, vitamin A and iodine are prevalent in the developing world.

National institute of nutrition (NIN) recommended for these problems are: (i) eat variety of foods to ensure balanced diet, (ii) eat protective foods rich in vitamins and minerals. (ii) eat folate rich foods for haemoglobin synthesis. (iv) eat plenty of fruits and vegetables which are rich sources of micro and macronutrients. Vegetables are rich sources of nutritional bioactive compounds. They are important sources of protective nutrients like vitamins, minerals, antioxidants, folic acid and dietary fibres. The diversified and highly nutritive vegetables are affordable and cost effective solution to hidden hunger and malnutrition. India has a rich heritage of indigenous fruits and vegetables. They are not only rich in minerals and vitamins but also, contribute in a big way in maintaining health, overcoming hunger and malnutrition. Per capita on average needs a daily diet which should provide 2800 calories, 55 g protein, 450 mg Ca , 20 mg Fe, 3000 mg  $\beta$  - carotene, 50 mg vitamin C, 100 mg folic acid, 1.0 mg vitamin B, 1.4 mg thiamine, 1.5 mg riboflavin, 19 mg niacin and 5 mg vitamin D. Vegetables are good source of all these nutrients (Sharma, 2009). Vegetables help combat malnutrition and

diversify diets. Dietary diversification balances the diet by enhancing the supply of essential micro-nutrients leading to improved health, such as improving functions of the whole body, disease prevention, and delayed disease progression enhanced thinking ability and increased efficiency. Examples include improvement in micro-vascular reactivity better cognitive performance decreased risk of colorectal cancer reduce the risk of overweight, coronary heart disease and reduced risk of kidney disease. Nutritional garden model especially for urban and peri-urban households which ensure healthy diet that contains adequate quantities of vitamins and macro and micro-nutrients by producing diverse kinds of vegetables. Malnutrition among the pre- school childrens can be used to determine the need for nutritional surveillance, nutritional care or appropriate nutritional intervention program in community. National Family Health Survey-4 (2015-16) data revealed 42.3% (Chhattisgarh-39.6%) of pre- school childrens are stunted and 53.1% (Chhattisgarh -39.2%) are under weight due to chronic under nutrition. India accounts for more than 3 out of every 10 stunted children in the world. The intake of protective foods like pulses, vegetables, milk and fruits are very low which leads to many nutritional deficiency disorders.

Malnutrition in Indian children continues to be of higher level with 42.3% being under weight, 58.8% stunted and 11% wasted. In India malnutrition and poor health status is a common problem of rural areas. It retards growth, increases the risk and duration of illness, reduces work output and slows social and mental development. For poor households, vegetables and fruits are often the only sources of micronutrients in the family diet. Homestead production of fruits and vegetables provides the households with direct access to important nutrients that may not be readily available or within their economic reach. So, home gardening would be a good means to improve household food security. Therefore, more attention towards home gardening as a strategy to enhance household food security and nutrition is to be needed. Globally, nutrition gardening contributes to household food security by providing direct access to food that can be harvested, prepared and fed to family members, often on a daily basis. Even very poor, landless or near landless people practice gardening on small patches of homestead land, vacant lots, roadsides or edges of a field, simple hydroponics, or in containers. Gardening may be done with virtually no economic resources, using locally available planting materials, green manures, "live" fencing and indigenous methods of pest control. Thus, home gardening at some level is a production system that the poor can easily enter. Gardening provides a diversity of fresh foods that improve the quantity and quality of nutrients available to the family. Nutrition gardening is especially important in rural areas where people have limited income-earning opportunities and poor access to markets. These gardens are also becoming an increasingly important source of food and income for poor households in peri-urban and urban areas. The major vegetable crops of Chhattisgarh are tomato, brinjal, potato, okra, onion, garlic, ginger, coriander, chilli, cauliflower, cabbage, radish, beet root, beans, sponge guard, bitter guard, green leafy (bhaji) and cucurbits etc. Vegetables are very important part of a good diet as they contain various nutrients for many body functions. These

vegetables also provide taste, palatability, better digestibility to us and increases the appetite. Vegetables are suitably grown in backyard space as they are mostly seasonal crops. The nutritional garden is generally located close to the house and is used for growing vegetables, fruits, and other food crops. It not only saves our money and time but also can provide a healthy, useful and environment friendly. Home gardens can help us in recycling of household waste especially when a compost pit is developed. One of the easiest ways of ensuring access to a healthy diet that contains adequate macro- and micronutrients is to produce many kinds of foods in the home garden. The challenge of increasing vegetables consumption is a major concern for health professionals. An estimated 6.7 million deaths worldwide were attributed to inadequate fruit and vegetable consumption in 2010. Further, the vegetables reaching the market contain high amount of pesticide residues, it is of special interest to the consumers to grow their own vegetables for domestic consumption. Application of pesticides for insect-pest and disease management is discouraged in the nutrition gardens. Therefore, present study was conducted on nutritional garden towards improving nutritional security in farm households.

Nutritional garden was established at individual farm households an area of 250 m<sup>2</sup> in backyard or side yard space. During the study quality seed and planting material of improved varieties in kharif, rabi and zaid seasons was provided. For the establishment of nutritional garden quality planting materials and seeds of papaya, durumstick, lemon and cury leaves and seven type of leafy vegetable (spinach, radish, amaranthus, fenugreek, chickpea, bathuva, musturd etc.), pumkin, bottal guard , bitter guard , sponge gourd, cow pea, green pea, tomato, brinjal, okra, chilli, coriander, carrot, beet root, cauliflower, cabbage, were provided among the beneficiaries. To assess the impact nutritional garden and average yield per unit was obtained. The dietary survey and feedback information from the selected households in order to assess their food consumption pattern pre and post was also recorded. The nutrient availability to every individual of farm households as per food composition. Nutrient availability was compared with the recommended dietary allowances. Per capita on average needs per day diet which should provide 2800 calories, 55 g protein, 450 mg Ca , 20 mg Fe, 3000 mg  $\beta$  - carotene, 50 mg vitamin C, 100 mg folic acid, 1.0 mg vitamin B, 1.4 mg thiamine, 1.5 mg riboflavin, 19 mg niacin and 5 mg vitamin D. Vegetables are good source of all these nutrients. "Eating a rainbow" of vegetables means including as much coloured vegetables into our daily diet. As the colours are an indication of vitamins and other nutrients, the coloured vegetables enhance the body's ability to prevent and fight diseases. The multitude of phytochemicals present in vegetables acts as anti-oxidant, anti-allergic, anti-carcinogenic, anti-inflammatory, anti-viral and anti-proliferative. Pigments from paprika are used as natural colourants in medicines and food items. Some of the neutraceutically rich vegetable crops are red and black carrot, beet root, tomato, chilli and broccoli. Based on colour vegetables are grouped.

**Table 1. Nutritional composition in vegetables per 100 g edible portion**

Vegetable crops	Energy (Kcal)	Moisture (g)	Protein (g)	Fat (g)	Carbo hydrates (g)	Fibre (g)
Amaranth	45.0	85.7	4.0	0.5	6.1	1.0
Asparagus	26.0	91.7	2.5	0.2	5.0	0.7
Basella	32.0	90.8	2.8	0.4	4.2	-
Bittergourd	25.0	92.4	1.6	0.2	4.2	1.7
Bottle gourd	12.0	96.1	0.2	0.1	2.5	1.5
Brinjal	24.0	92.7	1.4	0.3	4.0	-
Broad bean	48.0	85.4	4.5	0.1	7.3	-
Broccoli	37.0	89.9	3.3	0.2	5.5	2.6
Brussel's sprout	45.0	85.2	4.9	0.4	8.3	1.5
Bengal gram leaves	97.0	73.4	7.0	1.4	14.1	-
Cabbage	24.0	92.4	1.3	0.2	5.4	1.5
Capsicum	29.0	92.5	1.2	0.2	4.0	2.5
Chilli	29.0	82.6	2.9	0.6	6.1	6.7
Carrot	42.0	88.6	1.1	0.2	9.1	1.0
Coriander leaves	44.0	66.3	3.3	0.6	6.3	-
Cassava	157.0	59.4	0.7	0.2	38.1	-
Cauliflower	27.0	91.0	2.7	0.2	5.2	0.9
Celery	17.0	94.1	0.9	0.1	3.9	1.4
Cucumber	18.0	96.3	0.4	0.1	2.5	0.6
Drumstick leaves	92.0	76.0	6.7	1.7	12.7	0.9
Fenugreek leaves	49.0	86.1	4.4	0.9	6.0	1.1
French bean	30.0	62.0	6.3	0.1	29.8	4.0
Garlic	32.0	90.1	1.9	0.2	7.1	0.8
Kale	53.0	82.7	6.0	0.8	9.0	1.5
Knolkhol	29.0	90.3	2.0	0.1	6.6	1.1
Leek	77.0	78.9	1.8	0.1	17.2	1.3
Lettuce	14.0	95.1	1.2	0.2	2.5	0.6
Mint	48.0	84.9	4.8	0.6	5.8	2.0
Musk melon	17.0	95.2	0.3	0.2	3.5	0.6
Mustard leaves	34.0	89.8	4.0	0.6.	3.2	1.5
Okra	35.0	89.6	1.9	0.2	6.4	1.2
Onion	50.0	86.6	1.2	0.1	11.1	0.5
Pea	84.0	78.0	6.3	0.4	14.4	4.0
Potato	97.0	74.7	1.6	0.1	22.6	1.6
Parsley	16.0	90.0	2.2	0.3	1.3	-
Pointed gourd	20.0	92.0	2.0	0.3	2.2	3.0
Pumpkin	25.0	92.6	1.4	0.1	4.6	0.5
Radish	17.0	94.4	0.7	0.1	3.4	0.7

Sponge gourd	18.0	93.2	1.2	0.2	2.9	0.5
Spinach	26.0	90.7	3.2	0.3	4.3	-
Spinach beet	46.0	86.4	3.4	0.8	6.5	0.7
Sweet potato	124.0	68.5	1.8	0.7	28.0	1.0
Tomato	22.0	93.5	1.1	0.2	4.7	0.7
Turnip green	67.0	8.9	4.0	1.5	9.4	-
Watermelon	26.0	92.6	0.5	0.2	6.4	0.2
Nadru (Lotus root)	53.0	85.9	1.7	0.1	11.3	-
Yam	102.0	74.0	1.5	0.2	24.0	-
Taro corm (Arvi)	97.0	73.1	3.0	0.1	22.1	-
Giant Taro (Kachloo)	71.0	81.2	0.6	0.1	17.0	-
Cowpea leaves	51.0	84.6	4.3	0.2	8.0	-

**Table 2. Vitamin composition in vegetables per 100 g edible portion**

Vegetable crops	Vitamin A (IU)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin C (mg)
Amaranth	9,108	0.03	0.30	1.2	99.9
Asparagus	900	0.18	0.20	1.5	33.0
Basella	12,276	0.03	0.16	0.5	87.0
Bittergourd	208	0.07	0.09	0.5	88.0
Bottle gourd	traces	0.03	0.01	0.2	6.0
Brinjal	122	0.04	0.11	0.9	12.0
Broad bean	15	0.08	-	0.8	12.0
Broccoli	2,500	0.10	0.23	0.9	113.0
Brussel's sprout	550	0.10	0.16	0.9	102
Cabbage	130	0.05	0.05	0.03	47
Capsicum	900	0.06	0.06	0.5	175
Chilli (green)	454	0.06	0.03	0.6	111
Carrot	11,000	0.06	0.05	0.6	8
Coriander leaves	11,168	0.50	0.06	-	135
Cassava	700	0.05	0.10	0.3	25
Cauliflower	60	0.11	0.10	0.7	78
Celery	240	0.03	0.03	0.3	9
Cucumber	0.00	0.03	0.0	0.2	7
Drumstick leaves	11,187	0.06	0.05	0.8	220
Fenugreek leaves	3,861	0.04	0.31	0.8	52
French bean	10	0.06	0.23	0.4	13
Garlic	600	0.08	0.11	0.5	19
Kale	10,000	0.16	0.26	2.1	186
Knolkhol	20	0.06	0.04	0.3	66
Leek	30	0.23	0.06	0.5	25

Lettuce	900	0.06	0.06	0.3	8
Mint	2,700	0.05	0.20	0.4	750
Musk melon	279	0.11	0.08	0.3	26
Mustard leaves	4,200	0.03	-	-	33
Okra	172	0.07	0.10	0.6	13
Onion	35	0.08	0.01	0.4	11
Pea	640	0.35	0.14	2.4	27
Potato	32	0.10	0.01	1.2	17
Parsley	5,200	0.08	0.11	0.7	90
Pointed gourd	252	0.05	0.06	0.5	29
Pumpkin	2180	0.06	0.04	0.05	2
Radish	5	0.06	0.04	0.05	15
Bengal gram leaves	1564	0.09	0.10	-	61
Sponge gourd	369	0.02	0.06	0.4	0
Spinach	8100	0.10	0.20	0.6	51
Spinach beet	5862	0.26	0.56	3.3	70
Sweet potato	8800	0.10	0.06	0.6	21
Tomato	900	0.06	0.04	0.7	23
Turnip green	15691	0.31	0.57	5.4	180
Taro corm (Arvi)	166	0.09	0.03	-	0
Giant Taro (Kachloo)	-	0.31	0.57	5.4	180
Cowpea pods	941	0.07	0.09	0.9	13
Yam	-	0.1	0.01	0.8	15

**Table 3. Qualitative and quantitative carotenoid in vegetables**

Vegetables- carotenoids (mg/g fresh wt)	Total	$\beta$ -carotene	Major carotenoids
Asparagus ( <i>Asparagus officinalis</i> L.)	8.5	4.3-7.0	$\alpha$ -carotene. Lutein, Violaxanthin, Neoxanthin
Bitter gourd ( <i>Momordica charantia</i> L.)	5.3	2.3	$\alpha$ -carotene, $\beta$ -carotene. Zeinoxanthin. Lutein
French bean ( <i>Phaseolus vulgaris</i> L.)	17.1	2-4	$\alpha$ -carotene, $\beta$ -carotene. Lutein 5,6- epoxide. Neoxanthin, Violaxanthin
Broccoli ( <i>Brassica oleracea</i> var. <i>italica</i> Plenck.)	42.4	4.8	$\alpha$ -carotene. Lutein, Isolutein, Luteoxanthin, Violaxanthin, Neoxanthin, Chrysanthemaxanthin
Cabbage ( <i>Brassica oleracea</i> var. <i>capitata</i> L.)	8.9	0.8	$\beta$ -carotene. Lutein, $\alpha$ -carotene 5,6-epoxide, Neoxanthin, Violaxanthin, Chrysanthemaxanthin
Carrots ( <i>Daucus carota</i> L.)	54-124	76.0	$\beta$ -carotene, $\beta$ -carotene, J-carotene, $\hat{\alpha}$ -Zeacarotene, r-carotene, Neurosporene
Cauliflower ( <i>Brassica oleracea</i> var. <i>capitata</i> L.)	0.44	0.11	$\beta$ -carotene, Lutein, Violaxanthin, Neoxanthin
Cucumber ( <i>Cucumis sativus</i> L.)	17.2	2.20	$\alpha$ -carotene, $\beta$ -carotene and Cryptoxanthin

Pepper (Green) ( <i>Capsicum annuum</i> L.)	10.0	6.8	Capsanthin, Capsorubin, Cryptocapsin, $\beta$ -carotene
Pepper (Red)	127-284	1.27-2.84	$\beta$ -carotene, Violaxanthin, Neoxanthin
Lettuce ( <i>Lactuca sativa</i> L.)	68.0	10.8-24.5	$\beta$ -carotene, Lutein, Violaxanthin, Neoxanthin
Spinach ( <i>Spinacia oleracea</i> L.)	69.0	40.0	$\beta$ -carotene. Lutein epoxide, Violaxanthin, Lutein, Antheraxanthin, Neoxanthin
Tomato ( <i>Lycoopersicon esculentum</i> L.)	70-190	7.8	Lycopene, $\alpha$ -carotene, Phytoene.

Source: Pigments in vegetables: Chlorophylls and Carotenoids. Van Nostrand Reinhold, New York.

**Table 4. Groups of coloured vegetable crops:**

Colours of vegetables	Groups of coloured vegetable crops
Green	Artichoke, asparagus, amaranth, broccoli, Brussels sprout, celery, squash, Chinese cabbage, cucumber, endive, egg plant, beans green, cabbage green, onion green, pepper green, leek, lettuce, okra, peas, spinach, snap pea, watercress.
White	Cauliflower, garlic, Jerusalem artichoke, kohlrabi, egg plant, onion, parsnip, potato, shallot, turnip, white corn, white radish.
Red	Beet, radish, red capsicum, red pepper, red onion, red potato, tomato, watermelon, red amaranth
Yellow/Orange	Pumpkin and squashes, carrot, sweet corn, sweet potato, beet yellow, yellow capsicum, potato yellow, yellow tomato, watermelon yellow.
Blue/Purple	Egg plant, purple potato, purple cabbage, black carrot, purple cowpea, purple dolichos bean, purple capsicum and chilli



**Table 5. Vegetable production and consumption:**

S. No.	Name of Fruits and vegetables	Production (kg)		Consumption (gm /day)		Protein (gm)		Energy (Kcal)		Calcium (mg)		Iron (mg)		Vitamin A (Carotene) µg		Vitamin C (mg)	
		BF	AF	BF	AF	BF	AF	BF	AF	BF	AF	BF	AF	BF	AF	BF	AF
1.	Spinach	0.0	25.0	50.0	70.0	1.0	1.4	13.0	18.2	36.5	51.1	0.57	0.8	2790	3906	14.0	19.6
2.	Amranth	10.0	28.0	40.0	65.0	2.08	3.38	15.2	24.7	132	214.5	7.48	12.15	0.0	0.0	71.6	116.35
3.	Radish leaves	25.0	45.0	60.0	70.0	2.28	2.66	16.8	19.6	159	185.5	0.54	0.63	3177	3706	48.6	56.7
4.	Safflower leaves	0.0	48.0	0.0	65.0	0.0	1.6	0.0	21.4	0.0	120.2	0.0	3.7	0.0	2301	0.0	9.75
5.	Fenugreek	0.0	28.0	25.0	45.0	0.0	2.0	0.0	22.0	0.0	177.7	0.0	0.86	0.0	1053	0.0	23.4
6.	Bengal gram leaves	20.0	35.0	45.0	55.0	3.1	3.85	43.6	53.3	153	187	10.7	13.0	0.0	0.0	0.0	0.0
7.	Coriander	2.0	3.0	5.0	10.0	0.16	0.33	2.0	4.4	9.2	18.4	0.07	0.14	346	692	6.75	13.5
8.	Bottle Gourd	12.0	26.0	60.0	75.0	0.12	0.15	7.2	9.0	12.0	15.0	0.276	0.34	0.0	0.0	0.0	0.0
9.	Pumpkin	12.0	35.0	70.0	75.0	0.98	1.05	17.5	18.7	7.0	7.5	0.308	0.33	35.0	37.5	1.4	1.5
10.	Bitter Gourd	15.0	38.0	25.0	35.0	0.4	0.56	6.25	8.75	5.0	7.0	0.15	0.21	31.5	44.1	22.0	30.8
11.	Brinjal	22.0	45.0	40.0	60.0	0.56	0.84	9.6	14.4	7.2	10.8	0.15	0.48	29.6	44.4	4.8	7.2
12.	Lady finger	10.0	45.0	35.0	55.0	0.66	1.0	12.5	19.2	23.1	36.3	0.12	0.19	18.2	28.6	4.55	7.15
13.	Radish	22.0	55.0	30.0	55.0	0.21	0.68	5.1	9.35	10.5	19.25	0.12	0.22	0.9	1.65	4.5	8.25
	<b>Average</b>	-	-	37.30	56.5	0.88	1.5	11.4	18.69	42.6	80.78	1.57	2.54	494.4	908.7	13.7	22.63

BF =Before intervention. AF= After intervention.

Nutritional garden towards improving nutritional security through production of vegetables and fruits, their consumption are meager especially among the farm households. Now-a-days people are more health conscious and good food shall be our medicine. Increased consumption of fruits and vegetables is one of the easiest and cheapest ways of enhancing health. Many underutilized fruits and vegetables, which are rich sources of photochemicals are to be cultivated in backyard nutritional gardens. There is an increasing demand for indigenous, location specific underutilized vegetables and fruits. Homestead nutritional gardening is a low cost sustainable approach for mitigating malnutrition especially for farm households. Home gardening contributes to household food security by providing direct access to food that can be harvested, prepared and fed to family members, often on a daily basis. Nutritional gardening may be done with virtually no economic resources, using locally available planting materials, green manures, "live" fencing and indigenous methods of plant protection. Thus, home gardening is a production system that fits well in family farming system. It is concluded that establishment of nutritional gardens had immense role in tackling the problem of malnutrition and micronutrients deficiencies in farm households.

### **Nutritional garden model established**



