

# Year Round Fresh Vegetable Production from an Organic Kitchen Garden: Twelve Years' Experience of ARS, Pakhribas

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## Abstract

An organic kitchen garden was established at central farm of Agricultural Research Station, Pakhribas at an elevation of 1747 masl. The objectives of establishing the organic kitchen garden were to explore the potential of growing different types of vegetables without applying inorganic fertilizers and pesticides, and to demonstrate it to the mountain farmers not having access to external inputs. An observational study since 1993 revealed that harvest of 1.14 to 1.9 kg of vegetables per day is possible from a kitchen garden of 109.1 m<sup>2</sup> (net area for cultivation) area without the use of external inputs. Among thirty-one different vegetables grown, twenty-nine vegetable crops, excepting *Jarango* and *Barmeli Dhania*, have been identified suitable for cultivation. Coriander, spinach, fennel, anise and cress have been found appropriate as intercrops. A year-round production of vegetables in the kitchen garden is possible by adjusting species, cultivars and seasons. Locally available plant materials such as tobacco, *boke-timur* (*Zanthoxylum acanthopodium*) and *siltimur* (*Litsea cubeba*) are useful to maintain pests below economic threshold level.

## Introduction

Kitchen gardens are basic sources of vegetable products in Nepal especially in rural areas (VDD 1986). However, a few of the traditional crops such as pumpkin, radish, broad leaf mustard, chilli, cucumber and gourds are grown in limited land in an unorganized manner. It is apparent that these limited vegetables do not meet year round consumption requirements of a family even at a subsistence level. Preserved vegetables such as *Channa* from radish and *gundruk* from broad leaf mustard serve as a source of dry vegetables during especially in dry season, when other sources of green vegetables are in short supply.

Higher importance of organic farming is realized in the mountains due to unavailability of fertilizers and pesticides and a lack of knowledge on proper use of pesticides. Even if available, abuse, misuse and over use of pesticides are the problems in Nepalese context (Klarman 1987; Dahal 1995). Contrary to that, organic farming is gaining popularity in developed countries due to ecological friendliness, clean products, higher profitability, avoidance of pesticide hazards and ethics (Hong, 1994). Hence, organic vegetables farming have great importance in developed and developing world in one way or other. Organic kitchen gardening would also contribute to family-budget considering the constantly rising price of food as well as inorganic inputs. In addition, farmers can utilise organic household garbage that may otherwise be discarded as rubbish.

Considering the above constraints and opportunities, Agriculture Research Station, Pakhribas (then Pakhribas Agricultural Centre) tried to identify vegetable-crops, their sowing/transplanting time and organic technologies capable of producing fresh vegetables in kitchen garden without the use of inorganic agrochemicals. Subsequently, the kitchen

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garden was maintained as a demonstration plot. This paper highlights the findings of an organic kitchen garden.

## Objectives

The primary objective was to examine the possibility of year round fresh vegetable production in a kitchen garden without using inorganic agrochemicals. The secondary objective was to demonstrate such technology to farmers.

## Materials and Methods

Observations were recorded from kitchen garden demonstration plots maintained at ARS, Pakhribas from 1993 to 2006. Total area allocated for the kitchen garden, including a compost pit and a nursery, was 203.5 m<sup>2</sup>. Two small plots of 1.5 m<sup>2</sup> and 2 m<sup>2</sup> were used as a nursery bed and a compost pit respectively. Vegetables were cultivated in a net area of 109.1 m<sup>2</sup> divided into 23 plots of 1 m X 2.8 - 5.75 m size. The beds were prepared by using spade to cultivate the land and compost, wood-ash, decomposed leaves and farmyard manure (FYM) to fertilise the soil. The organic manures were well decomposed in pit to avoid white-grub in the soil, and applied at a rate of 50-80 kg/plot/year depending on the plot size and the crops being grown.

In the case of directly sown crops such as coriander, cress and radish the beds were thoroughly irrigated prior to sowing to facilitate better germination. Similarly, nurseries were irrigated the previous night to facilitate seedling removal with soil and thus to minimise post transplant seedling mortality. The seedlings were hand irrigated with a water-can as required. Taller crops such as cucumber, french-bean and broad-bean were transplanted/sown in the far west corner of the garden so as to avoid shading effect on neighbouring crops.

Thirty-one types of vegetable crops were included in the study. Among them were 14 leafy greens, eight fruit vegetables, 4 shoot vegetables and 5 root/bulb vegetables (Appendix 1). Short duration crops like cress, fenugreek and coriander were intercropped into the main crops to maximise the production from the kitchen garden. Furthermore, crops were rotated in the plots in such a way that deep-rooted followed shallow-rooted and legumes followed non-legumes in succession. Some plants of *Mentha arvensis* were also planted in the southern side of the plots. Locally available organic materials were used to suppress diseases and insect-pests as described by Duwadi *et al.* (1993).

## Results

Based on the observations during a period of 1993 to 2006, a total of 29 vegetable crops showed promising results (Table 1) in the organic kitchen garden.

*Jaringo* and *Barmeli Dhania* were also planted in the study. However, the productions were little, and the crops had limited uses also. A glimpse of total vegetable production in the plots is presented in Table 2.

The combined yield of the vegetable crops revealed that at least 1.14 kg of vegetables per day could be produced from the 109.1m<sup>2</sup> area. Average yield of most of the vegetables from the kitchen garden was found comparable with the conventional farming. Seed quality contributed to the variations in vegetable yields in different years. Other limiting factors were the attacks by diseases and insect pests. In the later years, attack of red ants (*Dorylus orientalis*) was the most serious one.



**Table 1. List of vegetable crops and their growing seasons**

S. N.	Vegetable crops	Growing season	S. N.	Vegetable crops	Growing season
1	Broad bean	Sept-Apr.	16	Pea	July-Jan
2	Swiss chard	May-Mar.	17	Knolkhol	Sept.- Jan.
3	Bunching onion	Perennial	18	Lettuce	Nov.-Jan.
4	Carrot	Year round	19	Broccoli	Sept.-Jan.
5	Cauliflower	Aug.-May	20	Spinach	Year round
6	Garlic	Aug.-May	21	Cress	Year round
7	Brinjal	Mar.-Sept.	22	Coriander (green)	Year round
8	Cabbage	Year round	23	Fenugreek (green)	Year round
9	Radish	Year round	24	Fennel (green)	Year round
10	Squash	Jan.-June	25	Anise	Aug.t-Jan
11	French bean	Feb.-Nov.	26	Shallot	Sept.-May
12	Broad leaf mustard	Year round	27	Amaranths	Mar.-Aug.
13	Chilli	Mar.-Oct.	28	Asparagus	Year round
14	Sweet pepper	Mar.-Sept.	29	Chinese cabbage	Sept.-Nov.
15	Onion	Aug.-June	16	Pea	Jul.-Jan.

**Table 2. Production of fresh vegetables from an organic kitchen garden**

S. N.	Vegetable type	Production year (kg)			
		1993/94	1994/95	1998/99	1999/2000
1.	Root and bulb	134.6	206.7	89.7	130.3
2.	Fruit	111.2	171.1	56.9	38.2
3.	Leafy greens	210.3	274.8	250.3	229.5
4.	Stem/shoot	28.5	31.1	12.0	22.8
Total production kg/year		484.6	683.7	408.9	420.8
kg/day		1.35	1.9	1.14	1.17

Sole cropping was not found efficient to utilize space properly in the early stage of crops. Intercropping of short duration crops such as coriander, spinach, fennel, anise and cress with long duration crops could maximize yield per unit area per unit time. It was also observed that the attack in the cultivated crop by flea-beetles was minimal due to repelling properties of cress, coriander, fenugreek and anise. Locally available materials proved useful for controlling insects and diseases. For example, cattle urine against powdery of summer squash and rust of peas and beans, *boke timur* (*Zanthoxylum armatum*) and *siltimur* (*Litsea cubeba*) to some extent against red ants of cauliflower, cabbage, aubergine, radish, carrot and capsicum, *Pyrethrum* and tobacco leaf against flea beetles of broad-leaf-mustard cauliflower, radish and cabbage and tobacco leaf and soap against aphids of radish, broad-leaf-mustard cabbage and broccoli.

### Discussion

Bhandari and Kayastha (1994) reported that per capita per day consumption of fresh vegetables including garden and wild collection among the mountain farmers in the western Nepal was about 115 g. However, according to the FAO standard 115 g still falls short for a balanced diet. FAO (1972) has recommended that an adult should consume 200 to 300 g of vegetables per day. The kitchen garden produced at least 1.14 kg of edible vegetables per day, which falls within the FAO standard, and suffices to feed a family of 6 adult members.



Anon (1993) reported that a kitchen garden of 200 m<sup>2</sup> is needed for a family of 5 to 6 members. Hence, our way of vegetables production in the organic kitchen garden is as good as that available in the literature. The study also indicated that there are still many avenues to increase production from the garden. First, short duration crops like cress, coriander, spinach and fennel should not be planted in the plots as main crops. Second, the vegetables should be chosen to suit the growing season. For instance, broad-leaf-mustard produced 1.4 kg/plot in off-season (July-August) against 45.5 kg/plot in the main season. Third, better understanding and use of natural pesticides will definitely help to increase vegetable production which is lacking in our context.

Nutrient management is a key issue of organic farming. It has been experienced that internal organic matter cycling was insufficient to meet the nutrient demand of the crops. Hence, organic matter or FYM should be arranged from external sources for successful gardening. However, the requirement could be minimised by cultivating legumes namely broad-bean, french-bean and pea. It is evident that incorporation of compost and FYM are sufficient to grow vegetables if they are applied in adequate amount. Hong (1994) reported that readily available nitrate nitrogen and electrical conductivity were higher in organically managed soils for ten years than average soils in Korea. It is an encouraging finding for the mountain farmers, where fertilizer is a critical limiting factor (Joshi *et al.* 1990).

During the observation it was also experienced that local practices of pests and diseases management were effective only when they were used in the beginning of infestation/infection (Duwadi *et al.*, 1993).

## Conclusions

Observations during the period suggested that kitchen gardening without the use of inorganic agrochemicals is possible in the middle mountain, and about an area of 200 m<sup>2</sup> is sufficient to meet organic fresh-vegetables need of a family. A year-round production of vegetables could be improved by adjusting new vegetable species and cultivars in different seasons.

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## Appendix 1. Name of the vegetable crops grown in the kitchen garden

1.1. Leafy greens: Amaranths (*Amaranthus spp.*), Anise (*Pimpinella anisum L.*), Barmeli *Dhania*, Broad leaf mustard (*Brassica juncea*), Cabbage (*Brassica oleracea var. capitata*), Coriander (*Coriandrum sativum L.*), Cress (*Lepidium sativum L.*), Fennel (*Foeniculum vulgare*), Fenugreek (*Trigonella foenum-graecum L.*), Japanese bunching onion (*Allium fistulosum*), *Jaringo* (*Phytolacca acinosa*), Lettuce (*Lactuca sativa L.*), Spinach (*Spinacia oleracea L.*) and Swiss chard (*Beta vulgaris var. cicla*).

1.2. Fruit vegetables: Aubergine (*Solanum melongena L.*), Broad bean (*Vicia faba*), Sweet pepper (*Capsicum annum L.*), Chilli (*Capsicum frutescence L.*), Cucumber (*Cucumis sativus L.*), French bean (*Phaseolus vulgaris L.*), Pea (*Pisum sativum*) and Summer squash (*Cucurbita pepo L.*).

1.3. Shoot vegetables: Asparagus (*Asparagus officinalis*), Broccoli (*Brassica oleracea var. italica*), Cauliflower (*Brassica oleracea var. botrytis*) and Knolkhol (*Brassica caulorapa*).

1.4. Root and bulb vegetables: Carrot (*Daucus carota L.*), Garlic (*Allium sativum L.*), Onion (*Allium cepa L.*), Radish (*Raphanus sativus*) and Shallot (*Allium ascalonicum L.*).