Diversification from Agriculture to Nutritionally and Environmentally Promotive Horticulture in a Dry-Land Area

Mahtab S Bamji, PVVS Murty
Dangoria Charitable Trust, Hyderabad, India

M Vishnuvardhan Rao
National Institute of Nutrition, Hyderabad, India

G Satyanarayana
ANGR Agriculture University, Hyderabad, India

Introduction

Cereal pulse-based Indian diets are qualitatively poor in vitamins and minerals due to inadequate consumption of vegetables and fruits – the major source of micronutrients in vegetarian diets.[1] Homestead gardens have been reported to improve access to and consumption of vegetables.[2, 3, 4] Homestead food production also helps with household food security.[2, 5]

This study has attempted partial diversification from the water-intensive cropping pattern (rice and sugar cane) to horticulture using green methods of farming in a dry-land area to improve household access to vegetables and environment security.

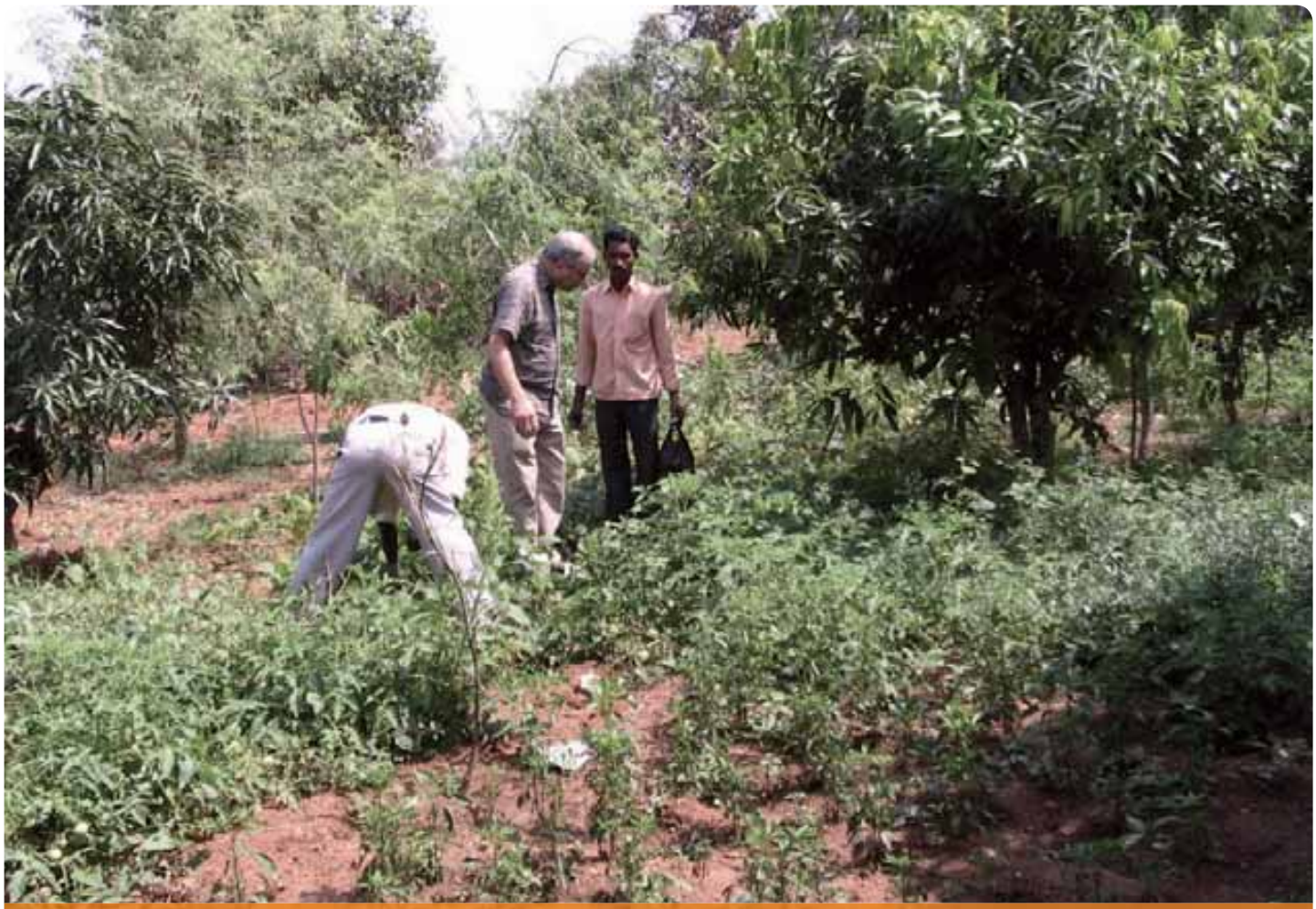
Subjects and methods

The study was conducted in 15 villages from 4 mandals (population 24,000), of the Medak district of the South Indian state of Andhra Pradesh. The project was explained in village-level meetings; 222 farmers who had land (marginal or small) and were willing to partially diversify from rice and sugar cane to horticulture (mixed orchards, vegetable gardens), and adopt green methods of farming, were identified. Seeds/seedlings of micro-nutrient-rich varieties of vegetable and fruit were distributed among the farmers identified. Drumstick, papaya, curry leaves *(Murraya Koenigii)* and creeper spinach *(Basilla alba)* seedlings were raised by village women in backyard nurseries and then purchased from them, providing them with some income.

Organic fertilizers, such as vermi compost, and botanical pesticides, such as neem kernel and chili garlic decoction, were promoted. Once every two months, experts were invited as faculty and centralized training programs were conducted on the campus of the Dangoria Charitable Trust (DCT) in the village of Narsapur. Hands-on training was also given via village-level meetings and visits to individual farms. In addition to horticulture, and the use of organic methods of farming, education in nutrition, health and environment formed an important part of the training. Focused group discussions (FGD) and slide and sound shows were organized in the evenings. School education was also an important part of creating awareness.

Impact assessment was carried out by making a record of diverted land, crops grown and their survival, the adoption of organic methods of farming etc. A rough estimate of vegetables sold and consumed at home was obtained by visiting households every month and making enquiries.

Baseline and end-line surveys on Knowledge, Attitude, and Practice (KAP) were carried out in four villages, representing three mandals, using a pretested questionnaire to test know-ledge on green methods of farming and nutrition. A diet survey using a semi-quantitative method was held to examine the impact on consumption of protective foods such as vegetables, pulses and animal products. This method involves obtaining information on the frequency of consumption of different foods by the family during a typical week (when there are no guests, festivities, or



Mixed orchards in India contribute to home food production and boost vegetable consumption

fasting), the daily quantity cooked and the number of household members above the age of one year (capita).

Based on this information, an estimate of mean quantity in grams of different foods consumed per capita per day was obtained. During the end-line survey, intake per consumption unit (CU),[1] in addition to per capita intake, was also ascertained by obtaining additional information on the sex, age, physiological status and activity of different members of the family (data not reported). However, the difference between per capita and per CU values was negligible. This method of diet survey can be applied in rural households where diets and menus are routine.

The initial survey in the four selected villages included all farmers who had agreed to participate in the project. All of the farmers who actually participated (stakeholders) were also included in the end-line survey (experimental group). This covered 82% of the initial cohort. Some farmers who initially accepted then dropped out, but some who were initially unwilling joined later on. To allow for the impact of time, in the end-line survey 50 farming households from the same villages who had not participated in land diversion were also interviewed (control group). However, even the control group farmers were allowed to participate in the training programs conducted in the villages. Due to material and human resource constraints, the KAP survey could not be carried out in all 15 villages. In addition, more than 50% of the farmers who joined the project were from the four selected villages. The two interviewers were trained and spoke the local language fluently.

"Monthly inquires suggested sales of 25–50% of the vegetables grown, with the rest being consumed at home"

TABLE 1: Knowledge of nutrition. Values are % of respondents. No prompting. Multiple answers.

Description	Initial March / April 2007	End-line Experimental March / April 2010	End-line Control March / April 2010
Number of respondents	125	128	50
Why do we eat food?			
Good health	70.4 ***	95.3	80.0 **
Gives energy	40.0 ***	76.6	64.0 **
Gives strength	32.8 ***	55.5	54.0
Protects against diseases	3.2 ***	63.8	24.0 *** ***
For living	5.6 ***	49.6	40.0 ***
For hunger	12.8	19.5	28.0 *
Any other	0.8	3.3	4.0
What are the components of a balanced diet?			
Cereals	63.2 ***	98.4	100.0 ***
Roti (dry pancakes from cereals and millets)	49.6 ***	71.1	60.0
Pulses	23.2 ***	95.9	66.0 *** ***
Vegetables	36.0 ***	98.4	70.0 *** ***
Fruits	38.4 ***	62.2	42.0 *
Green leafy vegetables	42.4 ***	81.1	38.0 ***
Milk	19.2 ***	77.3	56.0 ** ***
Eggs	13.6 ***	66.4	36.0 *** ***
Meat/fish etc	19.2	39.8	32.0
What are the functions of fruits and vegetables?			
Good health	64.0 ***	85.9	76.0
Gives energy	51.2	57.0	62.0
Gives strength	47.2	45.7	55.1
Protects against diseases	5.6 ***	69.6	22.0 *** ***
Improves eyesight	4.0 ***	58.0	52.0
Protects against anemia	0	75.8	34.0 *** ***
Makes teeth and bones stronger	0	37.6	16.0 **
For taste	0	39.1	52.0
Any other	0.8	3.1	2.0

The Two Proportion Z test was used to see the differences in proportions between two groups
* P<0.05, ** P0.01, *** P<0.001 compared to end- line experimental
* P< 0.05, ** P<0.01, *** P<0.001 compared to initial

TABLE 2: Food consumption: Weekly frequency and quantity consumed per capita per day.

Description	Initial March / April 2007	End-line Experimental March / April 2010	End-line Control March / April 2010
Number of respondents	125	128	50
Food			
Vegetables: frequency	3.85 ± 1.04^{c}	3.4± 0.631^{a}	3.1 ± 0.340^{b}
g /capita /day	57.7± 31.11^{ac}	52.3 ± 21.7^{a}	37.1 ± 10.34^{b}
GLV: frequency-mean	2.2 ± 0.72	2.9 ± 0.750	2.5 ± 0.614
g /capita /day	36.0 ± 20.08^{c}	51.6 ± 24.3^{a}	57.1 ± 24.4^{ab}
Pulses: frequency-mean	2.63 ± 1.08	2.8 ± 0.741	2.7± 0.519
g /capita /day	20.4 ± 13.03	19.0 ± 8.62	17.9 ± 5.52
Milk: frequency-mean	6.76 ± 1.30	6.94 ± 0.621	7.0 ± 0.000
g /capita /day	95.8 ± 138.68^{c}	71.3 ± 46.75^{a}	47.7 ± 18.78^{b}
Eggs: frequency-mean	1.3 ± 0.87^{a}	2.0 ± 1.458^{b}	1.9 ± 0.274^{bc}
number / capita / day	0.15 ± 0.1199^{a}	0.41 ± 1.16^{b}	0.3 ± 0.079^{b}
Meat: frequency-mean	1.02 ± 0.297^{a}	1.35 ± 0.685^{b}	1.64 ± 0.485^{c}
g /capita /day	18.49 ± 8.745^{a}	27.8±44.62^{b}	27.3± 9.36^{bc}

Means with different superscripts a, b, c are significantly different at $P<0.05$ using one way analysis of variance with post hoc LSD method.
Where necessary, the data was log-transformed and subjected to ANOVA to stabilize the variations in the groups.

Statistical methods

The statistical tests used to test significance are given as footnotes under each table.

Results

A total of 222 farmers diverted 62.1 acres of land to horticulture. Monthly inquiries suggested sales of 25–50% of the vegetables grown, with the rest being consumed at home. The impact of the project on participating farmers was marked in terms of knowledge of nutrition (functions of foods and components of balanced diet, particularly protective foods) **(Table 1)**. Responses suggest the contact effect of education. Thus, in the end-line survey, the knowledge of even the control group was better than it had been in the initial survey. Knowledge and the adoption of green farming methods also improved. Acceptance of botanical pesticides and vermi compost was good. Microbial products were introduced, but were not accepted due to lack of access to reliable material.

On average, the families consumed vegetables and pulses three times a week **(Table 2)**. In the end-line survey, families in the experimental group tended to report higher consumption of vegetables (52.3 g) compared to the control group (37.4 g), but not compared to the initial survey (57.7 g). Consumption of green leafy vegetables (GLV) tended to be higher in the end-line survey, compared to the initial survey. Pulse (dal) consumption took place two to three times a week, but only in quantities of about 20 g. Milk was consumed daily, mostly in tea. Milk consumption tended to be lower in the end-line than the initial survey – perhaps due to a price rise over the three-year period. Animal products such as meat (mutton, chicken, and fish) and eggs were consumed once or twice a week, in small amounts. Consumption of animal products tended to be higher in the end-line than the initial survey.

Over 95% of families in both surveys mentioned that they obtained their requirement of rice from their own farms or from the same village. In addition, in the end-line survey 90% of farmers mentioned that they obtained rice and pulses from the Public Distribution System (PDS) of the government, as compared to 10% in the initial survey. For other food grains, such as wheat, maize, sorghum, finger millet, pulses and vegetables and fruits,

over 50% of families depended on sources outside the village for their household requirements. In both the surveys, over 90% of families mentioned that they ate all of the above food grains, except maize, which a third of the families did not eat despite cultivating it.

"For poor households, economic compulsions outweigh nutritional wisdom"

Discussion

Diets were poor with regard to foods such as pulses, vegetables and animal products. The marked reduction in the mean consumption of vegetables in the control group in the end-line survey, as compared to the initial survey, demonstrates the adverse impact of the price rise. The experimental group seems to have been shielded against this effect, stressing the need to promote the homestead production of protective foods. An almost 44% increase in the consumption of GLV in the end-line, as compared to the initial survey, suggests the positive impact of nutrition education. The increase, which occurred even in the control group, is not surprising; growing GLV is easy and all of these were included in the community education efforts. Despite the fact that vegetable consumption was far below the recommended level, all of the farmers mentioned that they sold 25–50% of the vegetables grown. For poor households, economic compulsions outweigh nutritional wisdom. Village-level security for rice was better than that for other foods which had to be procured from outside sources. The fact that most families consumed cereals and millets other than rice suggests a healthy traditional practice of consuming mixed-grain diets. This needs to be nurtured, particularly since, in recent years, the preference for millets has declined due to easy access to rice and wheat.

In earlier studies[6,7] aimed at promoting home gardens to combat vitamin A deficiency in the Medak district, it was observed that home gardening alone may not be adequate to prevent vitamin A deficiency. Other methods, including the promotion of animal husbandry and poultry, would be needed to complement this food-based approach. In the authors' experience, diversification to horticulture from other crops requires considerable advocacy and persuasion, since farmers with marginal and small land-holdings hesitate to diversify from traditional crops. On the other hand, acceptance of back-yard poultry was good (unpublished).

In conclusion

Homestead gardening can have a positive impact on the consumption of horticultural produce, but this by itself will not meet the daily requirements in a small-farm-holding family where income is a priority. Poverty alleviation measures are needed to improve household food security.

Acknowledgements

The authors are grateful to the Department of Biotechnology, Government of India for financial support; the Dangoria Charitable Trust for logistical support, and Dr T Vishnumurthy and Sri Narsimha Reddy for training in horticulture.

Correspondence: ***Mahtab S Bamji,*** *Dangoria Charitable Trust DCT), 1-7-1074, Musheerabad, Hyderabad 500020, India*
E-mail: *msbamji@gmail.com*

References

01. National Nutrition Monitoring Bureau. Diet and nutrition status of population and prevalence of hypertension among adults in rural areas. Technical Report No. 24, National Institute of Nutrition, Hyderabad, India, Indian Council of Medical Research, 2006.
02. Talkukdar A, Haselow NJ, Osel AK et al. Homestead food production model contributes to improved household food security and nutrition status of young children and women in poor populations. Field Actions Science Reports (online), Special Issue 1: Urban Agriculture, online since 17 February 2010, accessed 13 June 2010. http// factsreports.revues.org/index404.html.
03. Rahman FMM, Mortuza MGG, Rahman MT et al. Food security through homestead vegetable production in the smallholder agricultural improvement project (SAIP) area. J Bangladesh Agril Univ 2008;6:261–69.
04. Iannoti L, Cunningham K, Ruel M. Improving diet quality and micronutrient nutrition. Homestead food production in Bangladesh. IFPRI discussion paper 00928, prepared for the project on Millions Fed: Proven Successes in Agriculture Development, November 2009;1–44. www.IFPRI.org/millions fed
05. Ndaeyo NU. Assessing the contributions of homestead farming to food security in a developing economy: A case study of Southern Nigeria. J Agri Soc Sci 2007;3:11–16
06. Vijayraghavan K, Nayak UM, Bamji MS et al. Home gardening for combating vitamin A deficiency in rural India. Food and Nutrition Bulletin 1997;18:337-343.
07. Murty PVVS, Lakshmi KV, Bamji MS. Impact of home gardening and nutrition education in a district of rural India. Readers' Forum. Bulletin of the World Health Organization 1999;77:784.