

<http://www.pjbs.org>

**PJBS**

ISSN 1028-8880

**Pakistan  
Journal of Biological Sciences**

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Farm Level Vegetable Production in Northwest Bangladesh-Experience of a GO-NGO Collaborative Program

<sup>1</sup>M.M. Uddin, <sup>1</sup>M.A. Mannaf, <sup>1</sup>M.A.H. Talukder, <sup>2</sup>M.B. Islam, <sup>1</sup>A.K. Saha, <sup>1</sup>S.M.A.H.M. Kamal and <sup>1</sup>S. Hasan  
<sup>1</sup>On-Farm Research Division, Agricultural Research Station, BARI, Rangpur, Bangladesh  
<sup>2</sup>Soil Science Division, Bangladesh Agricultural Research Institute, Gazipur, Bangladesh

**Abstract:** The main objectives of the study, among others, were to introduce modern techniques of vegetable production in the regional cultivation systems, to increase vegetable yield, to improve the nutritional status and thus improve the livelihood of the farm households. BARI provided technical assistance through direct supervision in the program. A large number of farmers (around 60,000) were involved in vegetable production program. The farmers grew about 20 vegetable crops including more than 30 different varieties. The yield and production of different vegetables increased tremendously over pre-intervention period. A remarkable quantity (258 ton) of quality vegetable seeds was produced through this program and around 1,10,000 ha of land was expected to be cultivated with the seeds. The farmers were able to produce and store the seeds required for their own use. Availability of credit and inputs including quality seed, training on production package, regular supervision by BARI technical staff and ensured marketing of the non-traditional produce were found to be the key factors behind the yield increase and acceptance of those crops/varieties by the farmers. The farmers had developed their skills on modern vegetable cultivation practices. They also had changed their food habit through the inclusion of more vegetables in their diet and thereby improved the nutritional status. The increased vegetable production also ensured them additional economic return and the better off position enhanced the social position of the farmers. The collaborative production systems made the farmers more confident on modern cultivation practices. It may be a glaring model of vegetable production under farmers' situation, transfer of technologies for higher and profitable production system and increase consumption of vegetables round the year, for income generation, employment opportunity and alleviation of poverty.

**Key words:** Vegetables, collaboration, adoption, consumption, income generation, employment

### INTRODUCTION

Vegetables are the good source of vitamins and minerals. An adult man or woman should consume at least 280 g vegetables per day (Ramphal and Gill, 1990). But the production and availability of vegetables in Bangladesh is very poor compared to the requirement. Only 2.5-3.0 million ton vegetables are produced in Bangladesh against the requirement of 9.5-10 million ton (Hossain, 1999). So, additional 7.0 million ton vegetables should be produced every year to meet up the requirement. The per capita consumption of vegetables in SAARC countries, namely, Nepal (42), Pakistan (69), Srilanka (120) and India (135 g) are higher than that of Bangladesh (Hossain *et al.*, 1990), China, Korea and Japan consume at least four times more than Bangladesh (Razzaque, 1999). So, vegetable production should be increased at least five folds for the present population of 135 million of the country. There is enough scope of increasing the yield of vegetables in the country by using modern varieties with improved production packages. Different agricultural institutions of

both GO and NGO have undertaken programs to face the challenge of increased vegetable production required for the balanced diet. However, there is limited linkage among the institutions especially between GO's and NGO's for the implementation of the said task. The present study was initiated to spell out the success of a combined and integrated effort of two organizations (one govt. agency and another one is an NGO) for augmenting vegetable production.

Bangladesh Agricultural Research Institute, a public sector research organization (GO) is working with a view to generate new and appropriate agricultural technologies which would be technically suitable, economically viable and socially acceptable to develop a sustainable agricultural production system (Anonymous, 1990). But BARI, by its mandate, has a limited scope to disseminate its generated technologies to the end users, i.e., the farmers. Government and Non-Government extension agencies have the mandate to disseminate the developed technologies amongst the farmers.

Grameen Krishi Foundation, a private sector (a sister organization of Grameen Bank – an NGO) is working in the Northwest part of Bangladesh with a view to increase agricultural production by utilizing its resources especially with its credit program since 1990 (Alam, 1998).

The North-West part of Bangladesh is located at 24°50'-26°30' N latitude and 88°20'-89°77' E longitude having rich in natural resources including fertile soils, water and other favorable climatic and agro-ecological factors. The area represents mostly high and medium high land. Soil texture is silty loam to clay and clay loam moderate to poorly drain soil with pH range 4.5-6.5 (Anonymous, 1998). The area experiences an annual rainfall of 1800-2400 mm with relatively early onset and late cessation. Similarly, the onset in winter is about 15 days earlier and the duration of winter is about a month longer compared to the other parts of the country. Ample ground water exists at a shallow depth throughout the area indicating a tremendous potential for the development of irrigated agricultural production system. Besides, the comparatively longer winter provides an ideal environment for the seed production of a large number of winter vegetables that indirectly helps in increasing the production. Average maximum temperature is 32.9°C and minimum is 10.2°C (average of last 10 years). BARI has been providing technical assistance in GKF's agriculture program to boost up the production since 1995 under a Memorandum of Understanding (MOU). According to MOU, BARI provided a team of scientific personnel including 2 scientists and 8 scientific assistants to work jointly with GKF workers in some selected farms of its working area. Deep tube-well/shallow tube-well areas including 200-300 farm families are referred to as a farm. Thus the collaborative program was initiated with the following objectives:

- Introduction of BARI developed vegetable technologies at farm level by utilizing GKF's inputs and thereby rapid dissemination of the technologies in the regional cultivation systems.
- Increase vegetable yield and production by using high yielding varieties developed by NARS institutes.
- Increase uptake of vegetables for balanced diet.
- Increase income and improve social status of the farm households.

#### **MATERIALS AND METHODS**

Bangladesh Agricultural Institute and Grameen Krishi Foundation, a private organization has been working jointly during 1995 to 2000. An impact study was conducted during 2000-2001 to measure the benefit achieved by the farmers through this program. GKF, as a

part of its annual development program, launched the vegetable production program in cooperation with its clients/beneficiaries at the farm level. As a part of MOU, BARI scientific personnel helped to execute the said program and some adaptive research programs in farmers field in collaboration with the concerned GKF officials and field workers. The representative farms were selected first for the implementation of joint program. Accordingly, appropriate production technologies, developed by BARI and other NARS institutes, were chosen and intervened to capitalize the potentialities. Modern production technologies with full-recommended packages were used. The production programs were jointly planned by BARI scientists and GKF workers well ahead of the cropping season and based on information like farmers' choice, price of produce, availability of seed, marketing facility, quantity of production, sharing systems etc.

Training programs for GKF field workers and farmers on production technologies were organized before and during each cropping season. Field days and farmers rallies were also organized on respective crops at different growth stages of the crops. BARI scientific staff continuously supervised the implementation right from seed sowing to harvesting and to some extent in developing the marketing channel. GKF provided the farmers with credit, which included cash as well as inputs like seed, fertilizer, insecticides, irrigation etc. Different sharing arrangements were made in different farms for different vegetable crops. In some farms, farmers had to pay 50% of the product of GKF and in some farms 15-20% service charge were collected from the farmers. It was observed that all the three partners i.e., BARI, GKF and the farmers had been benefited through this program.

A total of 75 farmers were selected randomly taking equal number each from Rangpur, Kurigram and Lalmonirhat district. Of them 50 were contact farmers and the rest 25 were common farmers. The common farmers acquired knowledge on the technologies by observing the collaborative activities, discussing related matters with the collaborator farmers and participating in the field days and farmers' rallies. The questionnaire included farmer category, farmers' experiences, land type, family size, crops and cropping patterns, input usage pattern, technologies used, off-farm activities etc. before and after initiation of the program. Yield potentiality of the crops, usage of economic returns incurred through this program, causes of increasing yield and return and the constraints faced were also included.

#### **RESULTS**

A total of 24 different vegetable crops involving more than 30 varieties were introduced to the farmers through this program. The farmers are now using almost all the

**Table 1: Vegetables and their varieties usually grown in the working area before the initiation of BARI-GKF collaborative program**

Crops	Variety	Yield range (t ha <sup>-1</sup> )
Brinjal	Local	5-8
Radish	Local	15-20
	Imported	20-30
Cauliflower	Hybrid (Imported)	8-10
Cabbage	Hybrid (Imported)	12-15
Country bean	Local	4-5
Lalsak	Altapeti	3-4
Data sak	Local (Bashpta, Katoa, Shureshury etc.)	8-10
Napasak	Local	3-4
Gourds (Sweet gourd, Bottle gourd, Ash gourd, Bitter gourds etc.)	Local	3-10
Okra	Local	2-3
	Imported	3-4
Indian spinach	Local	4-5
String bean	Local	3-4
Aroids	Local	5-6
Potato	Local	6-7
	HYV	12-15

vegetable crops and varieties. Higher yields were obtained with the intervened vegetables and varieties. The average yields of different winter vegetables increased by 137-877 and 48-577% in the farm of contact and common farmers respectively. Similar trend was also observed with the summer vegetables. The yields of different summer vegetables increased by 107-516 and 10-236% in the farms of contact and common farmers, respectively (Table 2). The increment in the production of

vegetables both during winter and summer were calculated considering the national average as base (Anonymous, 2000). Farmers of the working area produced a number of new vegetables as well as used improved seeds of other vegetables. The introduction of new vegetables and good quality seeds of modern varieties along with improved management practices contributed towards the diversification as well as increased production of vegetables compared to pre-intervention status of the area (Table 1). The production of different vegetables during winter and summer fluctuated over the years depending on the prevailing climatic condition and demand in the market. Availability of credit and inputs including quality seed, training on production package and regular supervision by BARI technical staff during implementation of the program were found to be the key factors behind increased production of vegetables. Besides, a number of field days and farmers' rallies (around 41) were organized during execution of the collaborative activities. A total of about 20,000 farmers participated in those field days, farmers' rallies. The attending farmers improved their knowledge on modern vegetable cultivation techniques. A large number of farm families (around 60,000) of this region developed their skill on said vegetable crops through the collaborative program and thus increased the production.

**Table 2: Vegetables and varieties introduced through BARI-GKF program and yield obtained during 1995-2002**

Crops	Variety	Yield (t ha <sup>-1</sup> )			% increased over national Average	
		National average	Under BARI-GKF (Av. Of 8 years.)		CF	CnF
<b>Winter vegetables</b>						
Radish	Tasakisun, Pinki and Druti	9.18	50.00	37.00	445	303
Tomato	BARI Tomato 2,3,6,7and8	5.63	55.00	38.00	877	577
Brinjal	Uttara, Kazla, Nayantara and Local	6.69	40.00	25.00	498	274
Country bean	BARI sim 1 and IPSA 1.	6.75	16.00	10.00	137	48
Spinach	Kapipalong	4.84	12.00	08.00	148	65
Gardenpea	BARI-1 and 2	1.12	06.00	04.00	436	257
Cabbage	Provati, Local and Hybrid	10.37	48.00	33.00	363	218
Cauliflower	Rupa, Local and Hybrid	7.74	37.00	24.00	378	210
Bottle gourd	BARI-1 and Khetlau	8.70	42.00	30.00	383	245
Red amaranth	BARI-1 and Altapeti	3.20	10.00	06.00	213	88
Bati sak	BARI	-	30.00	-	-	-
China sak	BARI	-	25.00	-	-	-
<b>Summer vegetables</b>						
Okra	BARI-1	3.25	15.00	09.00	362	177
String bean	Kegornatki	2.54	13.00	07.00	412	176
Kangkong	Gimakalmi	6.90	25.00	16.00	262	132
Red amaranth	BARI-1 and Altapeti	3.70	10.00	07.00	170	89
Stern amaranth	Baspata, katoa and labani	4.76	25.00	16.00	425	236
Indian spinach	Local improved, BARI -1	4.97	18.00	11.00	262	121
Sanake gourd	Zoom long	4.06	25.00	14.00	516	245
Bitter gourd	Gazkarola, Usche	3.90	09.80	05.10	151	31
Cucumber	Baromashi	4.38	12.00	08.00	174	83
Ribbed gourd	Local improved	4.13	17.00	10.00	312	142
Sweet gourd	Local (Rabi and Kharif)	7.25	15.00	08.00	107	10
Pointed gourd	Local improved	5.50	24.00	15.00	336	173

CF = Contact farmer, CnF = Common farmer. National Average: BBS, 2000

Table 3: Year wise vegetable seed production and the possible/projected area coverage with the produced seeds under BARI-GKF program during 1995-2002

Subject	Year							Total
	95-96	96-97	97-98	98-99	99-00	00-01	01-02	
Vegetable seed production (t)	7	12	43	50	45	53	48	258
Possible land area coverage (ha)	1816	3622	13701	24556	23290	27430	15544	109959

Vegetable seed : Both winter and summer

Table 4: Cropping patterns followed by the farmers before and after initiation of BARI-GKF program

Before initiation	% farmers used	After initiation (95-02)	% farmers used
Contact farmer			
Fallow -Jute-T. Aman	70	Potato-Jute-T. Aman	65
Tobacco-Fallow-T. Aman	50	Potato-Jute-Vegetables/Veg. Seed	80
Potato-Jute-T. Aman	65	Potato/Mustard-Boro-T. Aman	60
Wheat-Fallow-T. Aman	60	Veg./Veg Seed- Veg./Veg. Seed-Veg./Veg. Seed	85
Fallow-Boro-T. Aman	40	Veg./Veg Seed- Veg./Veg. Seed-T. Aman	75
Sugarcane	25	Maize-Fallow-T. Aman	70
-	-	Wheat-Jute-T. Aman	60
Common farmer			
Fallow-Jute-T. Aman	70	Potato-Jute-T. Aman	80
Tobacco-Fallow-T. Aman	50	Tobacco-Fallow-T. Aman	55
Potato-Jute-T. Aman	70	Potato-B. Aus-T. Aman	75
Wheat-Fallow-T. Aman	50	Fallow-Boro-T. Aman	35
Fallow-Boro-T. Aman	45	Wheat-Fallow-T. Aman	40
Sugarcane	30	Vegetable - B. Aus - T. Aman	30
		Sugarcane	10
		Vegetable-Vegetable-T. Aman	50

Table 5: Adoption % of recommended inputs used by the farmers in different crops under the collaborative program

Input	Vegetables		Veg. Seed		Tuber crop		Other crops (cereal, fibres etc.)	
	CnF	CF	CnF	CF	CnF	CF	CnF	CF
Seed	81	100	65	100	73	88	95	100
Fertilizer	61	95	45	100	71	72	40	75
Pesticides	43	85	63	93	46	74	33	57
Irrigation	54	86	47	93	50	83	40	68
Intercultural operation	64	81	41	91	76	81	63	65
Line/sowing/Transplanting	50	88	46	100	94	100	02	84
Bed preparation	22	84	54	99	44	93	03	08
Roguing	0	29	11	92	0	47	00	39
Post harvest processing	26	58	23	88	36	67	32	54

CnF = Common farmer, CF = Contact farmer

A remarkable quantity (258 t) of quality vegetable seeds was also produced through this program and around 109959 ha of land were expected to be cultivated with the seeds (Table 3). Major portion of seeds were distributed among the beneficiaries of GKF and Grameen Bank and the rests were sold in different parts of the country through GKF marketing channel.

**Analysis of survey result:** Around 30 of surveyed farmers were in large group (more than 2 ha of land), 30 in medium group and 40% in small and marginal group. About 80% of the farmers had more than 10 years experience on cultivation. About 25, 30 and 35% farmers were educated up to class five, eight and ten respectively and the rest 10% were S.S.C and above passed. The land type belonged to the surveyed farmers were 40% high, 50% medium high, 7% medium low and 3% low. About 80 incomes came from agriculture, 14 from business, 4 from service and the rest 2% from other sources irrespective of

farm categories. It was observed that most of the farmers (contact and common) had changed and improved their cultivation systems through diversified vegetable crops. Before intervention, only 10-15 crops were cultivated (Table 1) but after intervention about 24 vegetable crops were cultivated (Table 2). The cropping patterns have been improved through the inclusion of two or more vegetable crops with high yield potentialities and better management (Table 4). As sugarcane is a year round crop, inclusion of many diversified short durated crop in the cropping pattern. As a result sugarcane growers has been reduced. Usage of the number of crops and as well as the number of cropping patterns have been increased by both contact and common farmers over pre-intervened period. This was an indication of crop diversification for the area. The contact as well as common farmers had increased the input use (toward recommended package) in their cultivation (Table 5). The contact farmers were more advanced than those of common farmers in this regard.

Table 6: Utilization pattern of labour days (8 h day) in agricultural activities before and after initiation of BARI-GKF program

Farmer group	Before initiation					After initiation (94-02)					% increased
	Family labor			Hired labour	Total	Family labor			Hired labour	Total	
	Father	Mother	Children			Father	Mother	Children			
CF	0.75	0.50	0.25	5.00	6.50	1.25	0.90	0.60	11.00	13.75	112
CnF	0.60	0.50	0.15	3.00	4.25	0.90	0.70	0.40	5.00	7.00	65

CF = Contact farmer, CnF = Common farmer

Table 7: Utilization pattern of returns obtained from vegetables by contact and common farmer (%)

Farmer group	Land buying	Agril. equipments	Construction of house	Marriage	Medicare	Education	Others (Ricksha, Van, Auto-Rick- rice mill)
Contact farmer	10	29	15	5	8	10	23
Common farmer	5	16	29	13	14	9	14

Table 8: Change of food habit of farmers (farm households) due to intervention of BARI-GKF program

Farmer group	Food	Consumption day <sup>-1</sup> (g)			Times day <sup>-1</sup> (h)		
		Before initiation	After initiation	Increased over pre-intervention (%)	Before initiation	After initiation	Increased over pre-intervention (%)
Contact farmer	Carbohydrate (Rice/Bread)	518	616	19	2.7	2.9	7
	Protein (Fish/meat/milk/egg)	64	107	67	1.0	1.9	90
	Pulse	18	28	56	0.5	0.9	80
	Vegetables	98	227	132	2.0	2.8	40
Common farmer	Carbohydrate (Rice/Bread)	514	579	13	3.0	3.0	0
	Protein (Fish/meat/milk/egg)	53	73	38	1.0	1.4	40
	Pulse	16	20	25	0.4	0.6	50
	Vegetables	96	187	95	2.0	2.5	25

Both the contact and common farmers reported their increased income from vegetable sector after the initiation of BARI-GKF program and they opined that it was mainly due to increase of yields per unit area. The average income of common farmers increased by 40% (20-80%) and that of contact farmers increased by 57% (30-100%). The contact farmers cited four distinct factors, which influenced the increase of their income. They were as follows:

Factors	Opined farmers (%)
1. Use of modern and appropriate technologies (Vegetable/ variety/management/pesticides)	95
2. Easy and timely availability of inputs as well as <i>in situ</i> supervision by BARI-GKF technical staff.	85
3. Cautious supervision by field workers from seed sowing up to harvest	98
4. Received necessary training in the cultivation of different vegetable crops	90

Similarly the common farmers cited following two factors in favor of increased yield. They were:

Factors	Opined farmers (%)
1. Use of modern technologies	95
2. Acquired knowledge on modern technologies through participation in field days, farmers rallies organized by BARI-GKF collaborative program and thereby application in own field	90

**Utilization of labour:** Table 6 indicated that utilization of labour days (8 h day) increased during intervened period in both the contact and common farmers. Labour utilization was increased by 112 and 65%, respectively by the contact and common farmers compared to pre-intervention stages. Both the group of farmers effectively utilized family labour.

**Utilization pattern of vegetable return:** Table 7 indicated that both the category of farmers spent the returns in buying agricultural land, agricultural equipment, marriage, medicare, education and other various purposes (buying of rickshaw, van, auto rickshaw, rice mill etc.). The maximum return (29%) spent in buying agricultural equipments by the contact farmers, while the common farmers spent their maximum (29%) return in the construction and repairing of house.

**Change of food habit:** Both contact and common farmers had improved their food intake. The intake was more by the contact farmers compared to that of common farmer (Table 8). Carbohydrate, protein, pulse and vegetables consumption had been increased by 19, 67, 56 and 132% with contact farmers and on the other hand, it were 13, 38, 25 and 95%, respectively with the common farmers over

pre-intervention period. The vegetable consumptions were the highest in both the group of farmers.

### **CONCLUSIONS AND RECOMMENDATION**

It is apparent from the Table 1 to 8 that a large number of vegetable crops with their modern varieties were intervened. The yield and production of those vegetables increased through BARI-GKF collaborative program. A large number of farmers are now actively involved with the program. The farmers are also producing the seeds of different vegetables required for their own use. Availability of credit and inputs including quality seed, training on production package, regular supervision by BARI technical staff and ensured marketing of the non-traditional produce were found to be the key factors behind the yield increase and acceptance of those crops/varieties by the farmers. The local agro climatic situation also favored the farmers a lot. The farmers have developed their skills on modern vegetable cultivation practices. They have changed their food habit through inclusion of more vegetables in their diet and thereby improved the nutritional status. However, the increased production ensured them additional economic return and the better off position that enhanced social position of the farmers. The collaborative production system made the farmers more confident on modern cultivation practices. The BARI-GKF collaborative work may be a glaring model of vegetable production under farmers situation, transfer of technologies for higher and profitable production system, increase consumption of vegetables round the year, for generation of income and employment, alleviation of poverty and improvement of social status.

### **REFERENCES**

- Anonymous, 1990. Bangladesh Agricultural Research Institute (BARI), A Booklet Published by BARI, Gazipur, Bangladesh.
- Anonymous, 1998. Soil Resource Development Institute (SRDI), District Soil Survey Report, Dhaka, Bangladesh.
- Alam, M.S., 1998. Grameen Krishi Foundation, Annual report, 1998, Rangpur, Bangladesh.
- Anonymous, 2000. Bangladesh Bureau of Statistics (BBS), Ministry of Planning. Govt. of Bangladesh, Dhaka, Bangladesh.
- Hossain, A.K.M.A., M.A. Haque and M.S.U. Choudhury, 1990. In: Vegetable Research and Development in South Asia. Proceedings of a workshop held at Islamabad, Pakistan, 24-29 September 1990. Shanmugasundaram, S.S. (Ed.). AVRDC, Tainan, Taiwan.
- Hossain, S.M.M., 1999. Research Progress and Program on improvement of vegetables at BARI. In: Proceedings of a workshop on Vegetable research and development in Bangladesh. held during 28-29 January, 1999, Dhaka, Bangladesh.
- Ramphal, N. and H.S. Gill, 1990. Demand and supply of vegetables and pulses in South Asia. In: Vegetable research and development in South Asia. Proceedings of a workshop held at Islamabad, Pakistan, 24-29 September 1990. Shanmugasundaram, S. (Ed). AVRDC publication No. 90-331, AVRDC, Tainan, Taiwan.
- Razzaque, M.A., 1999. Vegetable Seed Situation in Bangladesh. In: Workshop on Development of Entrepreneurship in Vegetable Nursery and Seed Business in Bangladesh. Proceedings of a workshop held at Panda Garden, Dhaka, Bangladesh, 22-23 November 1999. AVRDC-USAID Bangladesh Project.