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Validation and Up-Scaling of High Value Vegetable Crop Production Technologies in the Sylhet Region

With its unique physiography and agro-ecology comprising hills, valleys and undulating plains the greater Sylhet region constitutes a special agricultural zone in northeastern Bangladesh. This region is traditionally reputed for citrus and tea cultivation. Various kinds of vegetables, although in a limited scale, are also grown in the Sylhet region. Demands for high value vegetable crops like sweet pepper (*Capsicum*), broccoli, summer tomato and summer country bean and their prices are increasing day by day not only in Sylhet but also in other parts of Bangladesh. About 21% of cultivable land in the Sylhet region remains fallow, the portion of and under yearly fallowing being the largest in comparison with other districts of the country. High rainfall, lack of irrigation facilities during the dry winter season, absentee farmers, high labour costs, etc. are the major hindrances against vegetable production in the Sylhet region. Horticulturists have developed a few high yielding inbred and hybrid varieties of these vegetable crops along with appropriate production technologies which offer good opportunities of boosting vegetable production to meet local and national demands for these high value crops. This research project was undertaken to validate and up-scale these modern technologies to enhance high value vegetable production in the Sylhet region.

The objectives of the project, specific for high value vegetable crop production in the Sylhet region, were to: 1) Select/identify the best varieties and production technologies and popularize the selected varieties and production technologies, 2) Increase household consumption level of vegetables among the local population and enhance the cash income of vegetable growers, and 3) Create famers' awareness and improve their knowledge and skills.

A baseline survey on targeted crops in relation to acreage, production and domestic consumption of the target vegetable crops was made at the beginning of the project in some selected upazilas of the technologies for these crops were conducted at the experimental farm of the Sylhet Agricultural University in the first year of the project. On-farm adaptive trials were conducted in the subsequent years for technology validation and up-scaling. The on-station field trials were completed in the first year, between July 2013 and June 2014. Two

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'training of trainers (TOT)' sessions were organized for DAE, BARI, BADC and NGO officials on the scopes, importance and production packages of high value vegetable crops in the Sylhet region. Ten farmer's training sessions on improved production technologies for high value vegetable crops were also organized in different upazilas of the Sylhet division. On-farm adaptive trials on the promising varieties and production technologies were carried out in farmer's fields of four districts of the Sylhet division in the second and third years to validate and up-scale the production technologies. The sites and farmers were selected with the help of local DAE officials. On-farm adaptive trials for sweet pepper and broccoli in 20 farmer's fields

and for summer tomato and summer country bean in 22 farmers' fields were conducted in the Habiganj and Sylhet districts in the second year of the project. In the third year, 24 farmers completed adaptive trials on sweet pepper and broccoli, 20 farmers on summer tomato and 50 farmers on summer country bean in Sylhet, Moulvibazar, Habiganj and Sunamganj districts. Four field days and two workshops were organized for technology display and dissemination.

Sweet pepper (*Capsicum*)

Production of *Capsicum* in open field conditions is very difficult due to different biotic and abiotic stresses like mite and aphid infestation, low night temperature, etc. Three selected *Capsicum* genotypes were evaluated under different protection structures in on-station and on-farm conditions. The genotypes, BARI mistimorich 1 and California wonder, were found very promising in respect of fruit yield (1.08 to 1.25 kg/plant). In on-farm adaptive trials, fruit yield was much higher in plant protection systems with 'net + polythene' covering or 'net-only' covering than that in an open field condition (Table 1). BCR was maximum (5.06) for the crop grown under net-only protection, but gross income was maximum (14740 Tk/decimal land) with net + polythene protection. However, the cost of production was higher (4200 Tk/decimal) for net + polythene protection compared with to net-only protection (2500 Tk/decimal). Consequently, farmers of the Sylhet region may be advised to grow sweet pepper under a net-only protection system for higher net incomes. Polythene covering may be used to protect the plants from low night temperatures during winter. However, to reduce the cost of production, the net-only protection should be practiced for *Capsicum*.

Table 1. Yield and economic analysis of *Capsicum* production under different protection systems

Production system	No. of fruits /plant	Yield/ plant (kg)	Yield (kg/deci)	Rate (Tk/kg)	Gross income (Tk/deci)	Cost (Tk/ deci)	Gross margin (Tk/ deci)	BCR
Net + Polythene	9.72	0.84	134	110	14740	4200	10540	3.50
Net-only	8.76	0.72	115	110	12650	2500	10150	5.06
Open	6.14	0.34	51	50	2550	1000	1550	2.55
Average	8.21	0.63	100	90	9980	2566.67	7413.33	3.70

Broccoli

Different broccoli genotypes viz., Green magic, Premium, Imperial, Green giant, Green crown, were evaluated during the winter season. Among the genotypes Imperial (110.2 kg/decimal), Green magic (92.16 kg/decimal) and Green giant (102.5 kg/decimal) were found very promising for high curd yield. However, sowing dates significant influenced yield attributes and yield of broccoli (Table 2). The maximum curd yield/decimal land was recorded with 10

November sowing (84.08 kg) followed by 25 October sowing (79.78 kg). In the Sylhet region, rainfall during the month of October is most common which adversely affected the seedlings ultimately hindering crop establishment and growth. So, for broccoli production in this region, seed sowing in the second fortnight of October or the first week of November is appropriate for a good broccoli harvest.

Table 2. Effect of planting time on yield and yield attributes of broccoli

Date of sowing	Days to first curd initiation	Days to first harvest	Individual curd wt. (g)	Curd breadth (cm)	Curd height (cm)	Curd yield/ decimal (kg)
10 October	77.33	93.33	354.7	13.95	14.08	64.10
25 October	70.67	83.33	440.0	15.43	15.87	79.78
10 November	74.67	91.44	471.5	16.53	15.57	84.08

Summer tomato

Different heat tolerant tomato hybrids were evaluated during summer. Among them, BARI hybrid tomato-4 was the highest yielder (29.24 t/ha) followed by the hybrid NHC1 (27.2 t/ha). An economic analysis indicated that farmers could get maximum net returns from BARI hybrid tomato-4 (Tk 5320/ decimal land). Seedling raising method was found to significantly influence the growth and yield of tomato during summer season (Table 3). The highest fruit yield per plant (0.93 kg) was recorded from plants raised with grafted seedlings followed by those with normal seedlings (0.83 kg). Again, mortality of the grafted plants was much lower (3.5%) compared with the plants from polybag seedlings (18.0%) and normal seedlings (20.0%) causing significant variation in fruit yield per decimal land.

Table 3. Effect of type of seedling on the growth and yield of BARI hybrid tomato-4

Type of seedling	Days to first harvest	No. of fruit/plant	Wt. of fruit/ plant (g)	Individual fruit wt. (g)	Harvesting duration (days)	Yield (kg/ decimal)	Bacterial wilt (%)
Polybag	80.50	20.99	785.45	37.70	29.16	128.0	18.0
Normal	81.83	20.11	835.02	40.70	30.83	131.5	20.0
Grafted	87.16	24.86	935.49	37.46	39.33	180.0	3.5

Summer country bean

Four photo-insensitive country bean genotypes were evaluated during the summer season of 2014 in an experimental field of the Horticulture Department, Sylhet Agricultural University. The genotype BP003 produced the maximum number of pods per plant (204.25) closely followed by SB010 (194.16). The genotype BP003 also had the highest individual pod weight (6.07 g) while it was the lowest for IPSA Sheem-2 (4.73 g). Among the genotypes, BP003 performed best in terms of per plant (1.25 kg) and per decimal (45.20 kg) yield followed by BARI sheem-7 (0.91 kg/plant). An economic analysis revealed that the highest gross margin (2640 Tk/decimal) could be achieved from BP003 followed by that from BARI sheem-7 (1710 Tk/decimal). Later on, the advanced line, BP003, released as Sikribi sheem-1.

Table 4. Yield and yield attributes of summer country bean genotypes

Genotype	Days to first harvest	Pod yield /plant (kg)	Pod yield/ decimal (kg)	Cost (Tk/ decimal)	Return/ decimal (@ 75 Tk/ kg)	Gross margin
BARI Sheem-7	82.0	0.91	32.80	750	2460	1710
SB010	81.5	0.87	31.32		2349	1599
BP003	84.5	1.25	45.20		3390	2640
IPSA Sheem- 2	92.5	0.80	28.80		2160	1410

The number of pods per plant and pod yield per plant were markedly affected by sowing dates (Table 5). The highest number of pods per plant was recorded from the plants of 15 March sowing (416.89) while it was 192.56 and 166.44 for January 15 and May 15 sowing, respectively. The highest pod yield per plant was recorded from March 15 sowing (2.20 kg) while it was 1.14 kg per plant for January sowing and 0.85 kg per plant for 15 May sowing. The crop sown in January experienced very low temperatures that slowed down initial vegetative growth and that sown in May suffered damage from pre-monsoon and monsoon rains; these might have been the reasons for the low yield with these sowing times. In the adaptive trials, farmers harvested 50-60 kg pods per decimal land that fetched Tk 65 to 85/kg from market sales. Estimates revealed a net profit of Tk 2000/decimal by growing country bean during summer season.

Table 5. Effect of sowing dates on growth and yield of summer country bean

Sowing dates	Days to flower	Days to harvest	Number of pods/ plant	Pod yield/ plant (kg)	Individual pod weight (g)
15 January	60.11	85.33b	192.56b	1.14b	5.80a
15 March	59.88	88.22a	416.89a	2.20a	5.12b
15 May	60.00	84.44b	166.44b	0.85b	5.13b

Benefits/outcomes of the project

- Opportunities of producing high value vegetables and possibilities of increasing their availability and consumption in the Sylhet region were demonstrated. Awareness, knowledge and skills in respect of *high value vegetable production in Sylhet region were enhanced.*

Recommendations

- Two sweet pepper (*Capsicum*) genotypes, which BARI Mistimorich-1 and California Wonder were identified as suitable for the Sylhet region.
- For *Capsicum*, a system of crop stand protection with coarse net (mosquito net) was perfected. Two photo-insensitive country bean lines were registered by the Ministry of Agriculture in 2015 for commercial cultivation and named as "Sikribi sheem-1" and "Sikribi sheem-2".
- The appropriate time of sowing of summer country bean, i.e., the month of March, for the Sylhet region was determined. BARI hybrid tomato-4 was identified as suitable for growing in the Sylhet region, while two advanced lines were found promising
- The broccoli varieties, Imperial, Green Magic, Green giant were selected for the Sylhet region and the proper sowing time, i.e., the second fortnight of October or the first week of November, for growing them determined.

Expected Impacts

- Fulfillment of the demands for high value vegetables in the Sylhet region
- Enhancement of incomes and improvement of nutrition status of farmers in Sylhet region

This bulletin has been prepared on the basis of technical information available from a completed CGP project of KGF, the details of which are given below:

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