Saudi Journal of Business and Management Studies (SJBMS)
Scholars Middle East Publishers
Dubai, United Arab Emirates
Website: https://saudijournals.com/

ISSN 2415-6663 (Print)
ISSN 2415-6671 (Online)

Potential Productivity and Yield Gap of Binasoybean-2 in the Research Station and Farm Level

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Article History
Received: 10.12.2018
Accepted: 18.12.2018
Published: 30.12.2018

DOI:
10.36348/sjbms.2018.v03i12.010

Abstract: The study was conducted in five major Binasoybean-2 growing areas of Bangladesh, namely Noakhali, Laxmipur, Chandpur, Barisal, Comilla. The major shares of total cost were human labour, power tiller, fertilizer and irrigation. The average total cost of production in field level of Binasoybean-2 is Tk. 31382.71. The net returns were Tk. 39738.40, Tk. 32353.80, Tk. 31467.89, Tk. 30499.63 and Tk. 20688.88 ha^{-1} followed by Chandpur, Laxmipur, Noakhali, Barishal, Comilla, respectively. The highest net return (Tk. 39738.40 ha^{-1}) was found at Chandpur district and the lowest net return (Tk. 20688.88 ha^{-1}) comes from Comilla district for Binasoybean-2. The undiscounted benefit cost ratio over full cost basis were 2.29, 2.02, 2.01, 1.98 and 1.65 for Binasoybean-2 in field level for Chandpur, Noakhali, Laxmipur, Barishal and Comilla, respectively. The highest Benefit Cost Ratio (BCR) is 2.29 in Chandpur district and the lowest BCR is 1.65 in Comilla district. The highest yield gap between research station and field level was in Comilla (397.50 kg ha^{-1}) and lowest in Chandpur (83.50 kg ha^{-1}). The yield gap between research station and farm level in percentage were 18.30, 8.49, 11.48, 40.43 and 21.30 for Binasoybean-2 in Noakhali, Chandpur, Laxmipur, Comilla and Barishal, respectively. Binasoybean-2 growers faced various constraints to Binasoybean-2 cultivation like, disease and pest infestation, non-availability of quality seed and fertilizer at proper time, lack of soil moisture during sowing time, lack of credit facilities etc. Binasoybean-2 production in the study areas is profitable. Binasoybean-2 farmers received higher return on their investment.
Keywords: Productivity, Yield gap, Binasoybean-2, Constraints and Policies.

INTRODUCTION

Soybean is a high value and profitable crop. Soybeans have become wildly important and popular in recent decades because of the rise in soy food's popularity, including soy milk and textured vegetable protein. The high levels of protein make these soy products an ideal protein source for vegetarians and the variety of soy products has created a massive new market altogether [1]. The economic viability of soybean production is determined by the commercial utilization of both its sub-products, meal and oil, which, account for about two thirds and one third of the crop's economic value, respectively. Soybean is the most important oil crops in Bangladesh. Out of the total cropped areas of 14.418 million ha, oil crops occupy about 0.366 million ha and the total production of the country stands at 0.786 million tones. Out of total oil copped area, Soybean occupies 0.041 million ha and production of soybean is 0.064 million tones [2]. The supply of soybean is very lower than the demand. Considering the ever increasing demand of edible oil of our country, it is extremely needed to increase the total production of oil crops by fitting the existing cropping patterns by replacing the high yielding variety (HYV) with low yielding varieties through improving management practices as well as increasing the area of cultivation where ever possible. Different soya foods like soya milk, soya biscuits, soya chapatti can be prepared from soybean. These crops can fulfill a great part of oil gap in the country. It has also diabetic, medical, industrial and agricultural importance [3].

Assessment of potential yield and the yield gap between potential and actual yield is essential before any investment for improving crop production for a location is made. Potential yield is determined by solar radiation, temperature, photoperiod, atmospheric concentration of carbon dioxide, and genotype characteristics assuming water, nutrients, pests, and diseases are not limiting crop growth. This is also called water non-limiting potential yield. Under rainfed situation where the water supply for crop production is not fully under the control of the grower, water-limiting yield may be considered as the maximum attainable yield for yield gap analysis assuming other factors are not limiting crop production. However, there may be season-to-season variability in potential yield caused by weather variability, particularly rainfall. Once the yield gap between water-limiting yield and actual yield is determined, then the relative contribution of other major constraints and limitations causing yield gap can be assessed in order to focus on the priority research or crop management needs to bridge the yield gap.

According to [4] the main challenges for research and development are to bridge the gap between actual and attainable yield by enhancing farmers' access to quality inputs, improved technologies and information. Total yield for the production zones ranged from 550 to 770 kg ha-1 for pigeonpea and 610 to 1150 kg ha-1 for chickpea [5]. According to [6] the overall gap in adoption of technologies was larger in the rain fed situation than in the irrigated situation. The yield gaps are mainly caused by biological, socio-economic, climate and institutional/policy related factors. In Bangladesh, despite the technologies developed by different National Agricultural Research System (NARS) institutes and extension agencies to disseminate the technologies, yield gaps exist in different crops of Bangladesh, such as rice, wheat, potato, oilseeds, pulses, etc. that may range from 19% to about 64% of the potential yield [7-11]. The existence of yield gaps was also observed in rice, mustard, and cotton in India [12]. In India, yield gap varied from 15.5 to 60% with the national average gap of 52.3% in the irrigated ecosystem [13]. Yield gaps in crops are real and the challenge needs to be addressed in the interest of increased and sustainable crop production. The objective of this review article is to discuss the causes contributing to yield gaps in crops, suggest strategies to minimize the gaps to increase yield and finally make recommendations mainly to the government/policy makers to develop guidelines or action plans to address the problem. The objectives were i) to identify the profitability of Binasoybean-2; ii) to determine the yield gap of Binasoybean-2 in the research station and farm level; and iii) to suggest key policies to minimize the yield gap.

RESULTS AND DISCUSSION

From table 10, it can be showed that the highest cost in farm level of Binasoybean-2 is in Laxmipur (Tk. 32146.45 ha^{-1}) followed by Barisal, Comilla, Chandpur and Noakhali in Tk. 31779.62, Tk. 31240.62, Tk. 30887.10 and Tk. 30859.76 ha^{-1}, respectively. The major shares of total cost were human labour, power tiller, fertilizer and irrigation. The average total cost of production in field level of Binasoybean-2 was Tk. 31382.71 (Table-1).

Table-1: Cost component of Binasoybean-2

Cost Component	Noakhali	Chandpur	Laxmipur	Comilla	Barishal	Average
Human-labor (man-days ha^{-1})	12439.47	12267.12	13220.5	12884.11	12855.2	12773.28
Power tiller	4286.50	4316.14	4657.26	4904.50	4410.64	4415.01
Seed	4075.16	3869.10	3990.88	4125.50	3575.40	3927.27
Fertilizer	**4079.32**	**4322.31**	**3972.95**	**74096.67**	**4406.66**	**4175.58**
Urea	640.45	679.45	705.02	630.46	790.98	689.27
TSP	1080.45	1110.25	1260.60	1170.13	1333.88	1191.06
MP	518.05	650.02	425.05	505.23	497.25	519.12
Gypsum	850.05	800.57	770.25	720.12	790.63	786.32
Organic manure	990.32	1082.02	812.03	1070.73	993.92	989.80
Pesticide and Insecticide	923.61	1080.21	935.10	760.44	893.56	918.58
Irrigation	1160.29	1052.23	1350.92	870.05	930.24	1072.746
Interest on operating capital	1555.01	1420.88	1560.46	1570.38	1510.33	1523.412
Total variable cost	**28519.36**	**28327.99**	**29688.07**	**29211.65**	**28582.03**	**28865.82**
Total Fixed cost	2340.40	2559.11	2458.38	2567.97	2658.59	2516.89
Total Cost	**30859.76**	**30887.10**	**32146.45**	**31779.62**	**31240.62**	**31382.71**

The gross return of Binasoybean-2 cultivation was found higher in Chandpur (Tk. 70625.50 ha^{-1}) followed by Laxmipur, Noakhali, Barishal and Comilla in Tk. 64500.25, Tk. 62323.65, Tk. 61740.25 and Tk. 52468.50 ha^{-1} among the study areas. The net returns were Tk. 39738.40, Tk. 32353.80, Tk. 31467.89, Tk. 30499.63 and Tk. 20688.88 ha^{-1} followed by Chandpur, Laxmipur, Noakhali, Barishal, Comilla, respectively. The highest net return (Tk. 39738.40 ha^{-1}) comes from Chandpur district the lowest net return (Tk. 20688.88 ha^{-1}) comes from Comilla district for Binasoybean-2. The undiscounted benefit cost ratio over full cost basis were 2.29, 2.02, 2.01, 1.98 and 1.65 for Binasoybean-2 in field level for Chandpur, Noakhali, Laxmipur, Barishal and Comilla, respectively. The highest Benefit Cost Ratio (BCR) is 2.29 in Chandpur district and the lowest BCR is 1.65 in Comilla district. It indicates that all of farmers of Binasoybean-2 are economically profitable (Table-2).

Table-2: Profitability of Binasoybean-2

Type	Noakhali	Chandpur	Laxmipur	Comilla	Barishal	Average
Yield (kg ha^{-1})	2475.03	2685.50	2550.15	2029.50	2340.55	2416.15
Yield (Tk. ha^{-1})	62327.65	70625.50	64500.25	52468.50	61740.25	62332.43
By product (Tk./ha)	2223.10	2370.15	2330.14	2150.10	2190.75	2252.85
Gross Return	62327.65	70625.5	6450.25	52468.5	61740.25	62332.43
Total variable cost	28619.36	28327.99	29688.07	29211.65	28582.03	28865.52
Total Cost	30859.76	30887.10	32146.45	31779.62	31240.62	31382.71
Gross Margin	**33808.29**	**42297.51**	**34812.18**	**23256.85**	**303158.22**	**33466.61**
Net Return (Tk. ha^{-1})	**31467.89**	**39738.40**	**32353.80**	**20688.88**	**30499.63**	**30949.72**
Benefit Cost Ratio (Undiscounted)	**2.02**	**2.29**	**2.01**	**1.65**	**1.98**	**1.99**

Table-3: Yield gap between research station and farm level of Binasoybean-2

District	Yield in Research Station(Kg/ha)	Yield in Farm Level(Kg/ha)	Yield Gap between Research Station and Farm Level (Kg/ha)	Yield Gap between Research Station and Farm Level as Area (%)
Noakhali	2655.00	2475.03	179.97	18.30
Chandpur	2769.00	2685.50	83.50	8.49
Laxmipur	2663.00	2550.15	112.85	11.48
Comilla	2427.00	2029.50	397.50	40.43
Barishal	2550.00	2340.55	209.45	21.30
Total	13064.00	12080.73	983.27	100.00
Average	2612.80	2416.15	196.65	-

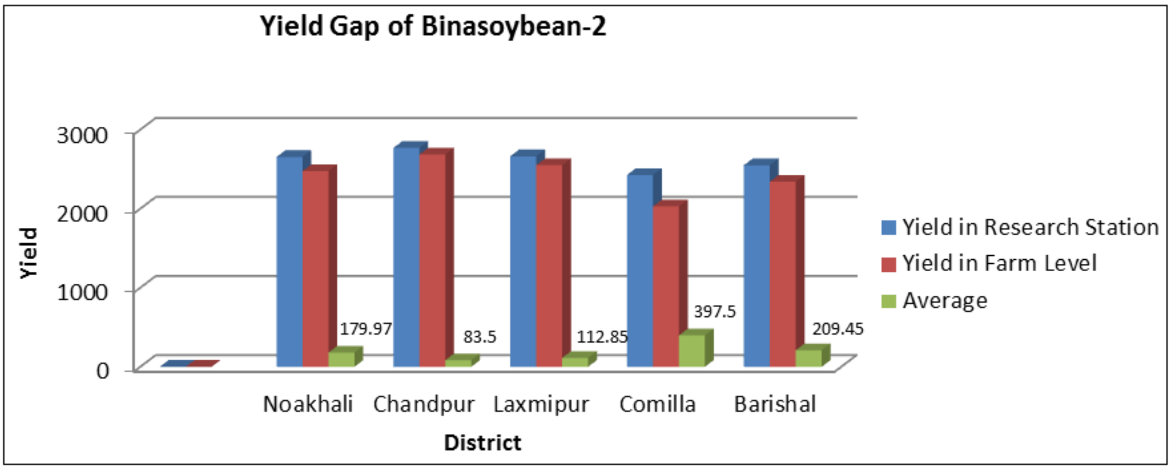

Fig-1: Yield Gap of Binasoybean-2

The average yield gap of Binasoybean-2 in farm level and research station was 196.65 kg per hectare. The yield gap between research station and farm level were 179.97 kg, 83.50 kg, 112.85 kg, 397.50 kg and 209.45 kg per hectare for Binasoybean-2 in Noakhali, Chandpur, Laxmipur, Comilla and Barishal, respectively (Table-3). The highest yield gap between research station and field level was in Comilla (397.50 kg ha^{-1}) and lowest in Chandpur (83.50 kg ha^{-1}). From table 3 also found that the yield gap between research station and farm level in percentage were 18.30, 8.49, 11.48, 40.43 and 21.30 for Binasoybean-2 in Noakhali, Chandpur, Laxmipur, Comilla and Barishal, respectively.

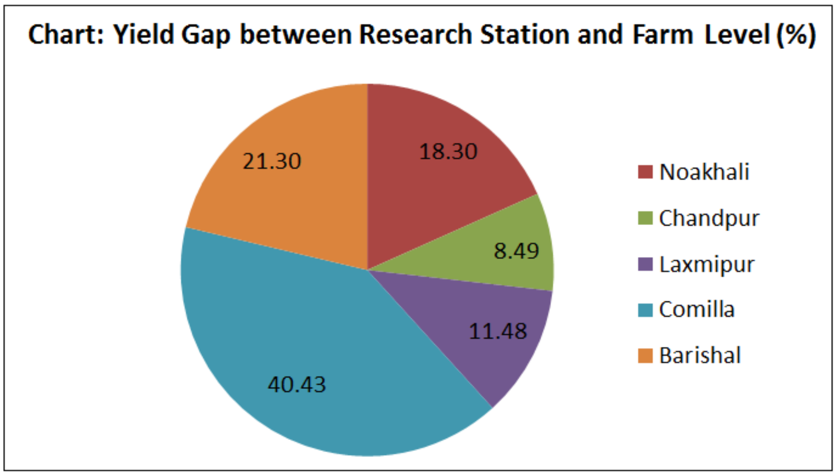

Fig-2: Yield Gap between Research Station and Farm Level (%)

Constraints to Binasoybean-2 Cultivation

Binasoybean-2 growers farmers faced various constraints to Binasoybean-2 cultivation like, disease and pest infestation, non-availability of quality seed and fertilizer at proper time, lack of soil moisture during sowing time, lack of credit facilities and lack of knowledge about improved technology were reported to be main constraints to Binasoybean-2 cultivation in Bangladesh.

Table-4: Constraints of Binasoybean-2 cultivation

SL. No.	Constraints	Rank Value
1.	Disease and pest infestation	1
2.	Non availability of quality seed and fertilizer at proper time	2
3.	Lack of soil moisture during sowing time	3
4.	Lack of credit facilities	4
5.	Lack of knowledge about improved technology	5

Policies to Reduce the Yield Gap

Government should take appropriate action through law enforcement team to stop the use of adulterated insecticide and fungicide throughout the country. It should need to provide quality seed and fertilizer in appropriate time. Some techniques should be used to reduce the lack of soil moisture during sowing time. Different Government and commercial bank should widen their area to provide loan to the farmers for smooth running of small farming. Most of the farmers did not follow the recommended doses of inputs in the production process. So the field workers of the Department of Agricultural Extension (DAE) should be more careful about the proper dissemination of the scientific technology.

CONCLUSION

It is concluded from the aforesaid discussion that the Binasoybean-2 production in the study areas is profitable. Binasoybean-2 farmers received higher return on their investment. Although Binasoybean-2 is a profitable crop, farmers could not harvest expected benefit due to various problems. The quality seed of the existing improved variety should be made available to the farmer for greater extension of this crop.

Conflict of interest: None to declare

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