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Economic analysis of early and late maturing rapeseed and mustard genotypes

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ABSTRACT

Rapeseed and mustard dominate the oilseed cultivation in Bangladesh. Exploration of both long duration and short duration rapeseed and mustard can reduce the gap between demand and production of oilseed. The aim of this study was to identify the difference in economic return between late maturing and early maturing rapeseed and mustard genotypes in terms of benefit-cost ratio. Two early maturing and twenty late maturing rapeseed and mustard lines were used for economic analysis. Three late maturing lines M-215, M-219 and M-224 showed outstanding results yielding 4.56 , 4.16 and 3.85 t ha^{-1}; respectively. The benefit-cost ratio of these three lines over total cost were 4.34, 3.97 and 3.67; respectively. Whereas two early maturing varieties namely Tori-7 and BARI Sarisha-14 accounted for benefit-cost ratio of 1.29 and 1.43, respectively; which were far too low from the selected lines. The findings of this study indicated that the late maturing lines are more profitable in terms of benefit-cost ratio although they showed declination in cropping intensity.

Keywords: Late maturing, early maturing, rapeseed and mustard, economic profitability

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1 Introduction

Oilseeds are one of the key shareholders of the worlds' agriculture. After soybean and palm, rapeseed and mustard are the most popular oilseeds worldwide. In 2019-20, rapeseed-mustard became the second largely produced oilseed by a staggering production of 68.2 million metric tons worldwide (Statistica, 2020). In Bangladesh, rapeseed and mustard are the largest source of oilseed covering 78% of oilseed producing area and 40% of total oilseed production comes from mustard (BBS, 2019). Globally, the oilseed production has grown remarkably over the past few years (Carré and Pouzet, 2014), but in Bangladesh oilseed crop productivity is declining (Nur-E-Nabi et al., 2019).

Despite of this low production, the annual edible oil consumption is still on the rise in Bangladesh. According to USDA (2019), it will rise by 11% from the fiscal year 2018-19 to 28.50 lakh tons in the marketing year 2019-20. USDA report also indicated that edible oil imports might hit up to 2.8 million tons in the year 2019-2020. Government spent 1656.3 million US$ for importing edible oil in the fiscal year 2018-19 and also spent 794.6 million US$ for importing oilseeds. The amount spent on oilseed import was 39.5% greater than the amount spent in 2017-18 (BB, 2019). As a largely populated country, this rising demand for edible oil will continue to rise and the country will need to spend a huge amount of currency on it in future. This huge oil crisis could be resolved by boosting the national production of oilseeds. Rapeseed-mustard, sesame, linseed, groundnut, cocoanut, castor are commonly cultivated oilseeds in Bangladesh. Soybean cultivation is insignificant; moreover, palm oil is not cultivated in Bangladesh. Among all oilseeds, rapeseed and mustard are cultivated on a larger scale in different parts of Bangladesh (BBS, 2019). Therefore, looking for high yielding and more profitable rapeseed and mustard varieties would be feasible to combat the rising oil demand.

Besides selecting new lines, ensuring their economic profitability is mandatory for the farmers to get an adequate return from their cultivation. Unprofitable lines can worsen the ongoing oilseed crisis. Economic profitability analysis of late maturing and early maturing rapeseed and mustard genotype has not been carried out to date, so far as we have explored. So, in this study, economic profitability of the late maturing wild genotypes and existing early maturing varieties was explored for identifying lines with greater economic profit than the existing early maturing one. However, nowadays farmers are looking forward to the short duration varieties, as they increase cropping intensity and allow farmers to prepare their land early for the next crop. So, it is crucial to know whether the cultivation of late maturing varieties are economically profitable compared to early maturing varieties. Therefore, the objective of the present study was to find out the difference between the late and early maturing rapeseed and mustard genotypes in terms of yield and economic return. The results of this study would provide new information on the economic profitability of late maturing rapeseed and mustard lines.

2 Materials and Methods

2.1 Experimental site and plant material

A field study was conducted taking 22 rapeseed and mustard genotypes two early maturing varieties and twenty late maturing lines those were then collected from the mustard germplasms of the department of Genetics and Plant Breeding (Table 1). The experiment was conducted at the field laboratory of the Department of Genetics and Plant Breeding, Bangladesh Agricultural University, Mymensingh, following a randomized complete block design (RCBD) with three replications (Jyoti et al., 2021). All genotypes were grown in the Rabi season and exposed to the same environmental condition. The individual plot size was (1 m × 2 m) m^2. All intercultural operations (weeding, irrigation, fertilization, etc.) were done properly. Yield per plot was recorded and converted to yield in t ha^{-1}.

2.2 Economic analysis

Economic profitability of late maturing varieties over early maturing varieties was determined by calculating benefit-cost ratio. Gross return was estimated by multiplying the yield ha^{-1} of a genotype by the average market price (Dillon and Hardaker, 1993). The market price values were taken from Miah and Mondal (2017).The gross margin was measured as the difference between gross return and total variable cost. Net return was measured by deducting total cost from the gross return. Benefit–cost ratio (BCR) was measured as a ratio of gross return to gross cost (Uddin and Dhar, 2020). The following equations were used for the calculations:

$$GR = (Y_{mp} \times P_{mp}) + \left(Y_{bp} \times P_{bp}\right) \quad (1)$$

$$GM = GR - TVC \quad (2)$$

$$NR = GR - TC \quad (3)$$

$$BCR = \frac{GR}{GC} \quad (4)$$

where GR =gross return, Y_{mp} = yield of main product, P_{mp} = price of main product, Y_{bp} = yield of byproduct, P_{bp} = price of byproduct, GM = gross margin, TVC = total variable cost, NR = net return, TC = total cost, BCR = benefit-cost ratio and GC = gross cost.

3 Results and Discussion

The majority of the late maturing lines showed higher yield potential compared to the early maturing varieties because of their prolific branching habit (Jyoti et al., 2021). Two early maturing varieties BARI Sarisha-14 and Tori-7 yielded 1.5 and 1.35 t ha^{-1}, respectively. Fourteen late maturing genotypes recorded greater yield than the early maturing varieties (Fig. 1). Among them, three genotypes M-215, M-219 and M-224 yielded 4.56, 4.16 and 3.85 t ha^{-1}, respectively. Yield of other six late maturing genotypes ranged from 0.86 to 1.4 t ha^{-1} (Fig. 1). Gross income of Tori-7 and BARI Sarisha-14 were 749 and 829 US$, respectively (Table 2). Gross income of late maturing varieties ranged from 608 US$ to 2523 US$. The gross income of genotype M-215, M-219 and M-224 were 2523, 2304 and 2134 US$; respectively (Table 2). The gross income of these three late maturing lines was almost three times higher than that of the two early maturing lines. A BCR over the total variable cost of two early varieties were 2.81 and 3.11. Whereas,the BCR over the total variable cost of late maturing varieties ranged from 2.28 to 9.47. The BCR over the total cost of two early varieties was 1.29 and 1.43. The BCR over the total cost of late maturing varieties ranged from 0.82 to 4.37 (Table 2).

Productivity of agricultural products should be economically feasible for a better and sustainable cultivation. Besides higher yield, proper economic return should be ensured. The profitability of rapeseed and mustard cultivation in Bangladesh has been studied (Islam et al., 2007; Miah and Alam, 2008; Dey et al., 2013). Begum et al. (2020) conducted profitability analysis of BARI Sarisha-14, finding it more profitable than the old mustard variety with a BCR of 1.26.

Table 1. Name, species, category and days to maturity of plant materials

Genotypes	Species	Category	Days to maturity
Tori-7	*Brassica rapa*	Early	92
BARI Sarisha-14	*Brassica rapa*	Early	85
M-111	*Brassica juncea*	Late	100
M-115	*Brassica juncea*	Late	100
M-154	*Brassica juncea*	Late	104
M-161	*Brassica juncea*	Late	104
M-162	*Brassica juncea*	Late	104
M-163	*Brassica juncea*	Late	103
M-164	*Brassica juncea*	Late	104
M-165	*Brassica juncea*	Late	104
M-166	*Brassica juncea*	Late	100
M-169	*Brassica juncea*	Late	103
M-215	*Brassica rapa*	Late	102
M-218	*Brassica rapa*	Late	104
M-219	*Brassica rapa*	Late	102
M-221	*Brassica rapa*	Late	100
M-222	*Brassica rapa*	Late	100
M-224	*Brassica rapa*	Late	103
M-233	*Brassica rapa*	Late	104
M-235	*Brassica rapa*	Late	104
M-236	*Brassica rapa*	Late	104
M-241	*Brassica rapa*	Late	104

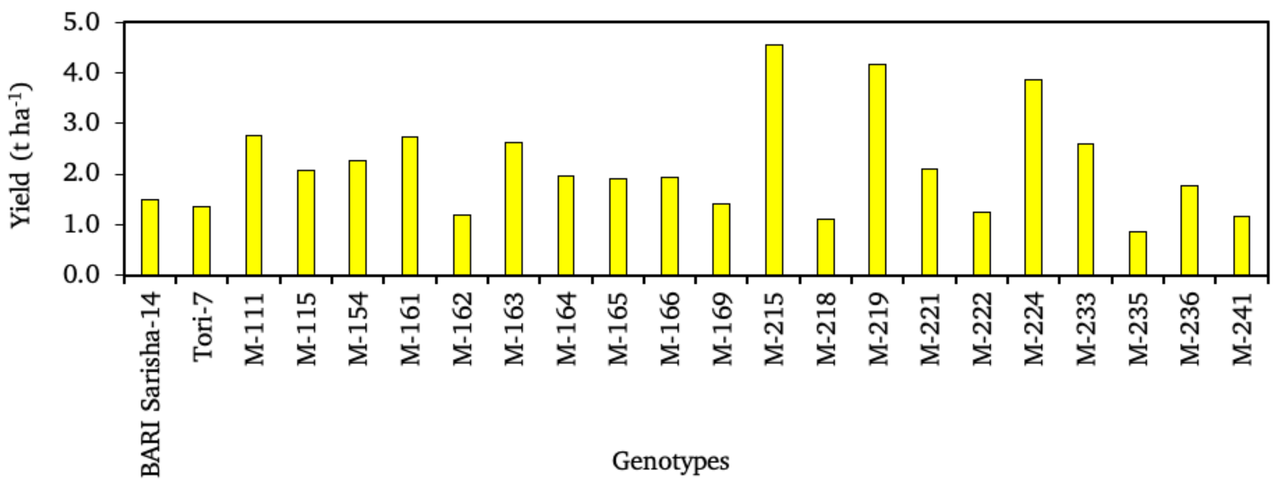

Figure 1. Yield performances of early maturing and late maturing mustard genoytpes

Table 2. Economic profitability of late maturing and early maturing rapeseed and mustard genotypes

Genotypes	Tori-7	BARI Sarisha-14	M-111	M-115	M-154	M-161	M-162	M-163
Y (kg ha^{-1})	1353	1498	2752	2067	2247	2719	1181	2620
P† (US$ kg-1)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
MP (US$ ha^{-1})	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
BP (US$ ha^{-1})	37	42	76	57	62	75	33	73
GI (US$ ha^{-1})	749	829	1523	1144	1244	1505	654	1450
TVC (US$ ha^{-1})	280	280	280	280	280	280	280	280
TFC (US$ ha^{-1})	37	42	76	57	62	75	33	73
TC (US$ ha^{-1})	610	610	610	610	610	610	610	610
GM	786	871	1600	1201	1306	1580	687	1523
NR (US$ ha^{-1})	176	261	990	591	696	970	76	913
BCR/TCV	2.81	3.11	5.72	4.3	4.67	5.65	2.45	5.44
BCR/TC	1.29	1.43	2.62	1.97	2.14	2.59	1.13	2.5
Genotypes	M-164	M-165	M-166	M-169	M-215	M-218	M-219	
Y (kg ha^{-1})	1951	1896	1928	1410	4557	1098	4162	
P† (US$ kg-1)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
MP (US$ ha^{-1})	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
BP (US$ ha^{-1})	54	53	53	39	126	30	115	
GI (US$ ha^{-1})	1080	1050	1067	781	2523	608	2304	
TVC (US$ ha^{-1})	280	280	280	280	280	280	280	
TFC (US$ ha^{-1})	54	53	53	39	126	30	115	
TC (US$ ha^{-1})	610	610	610	610	610	610	610	
GM	1134	1102	1121	820	2649	638	2419	
NR (US$ ha^{-1})	524	492	511	210	2039	28	1809	
BCR/TCV	4.05	3.94	4.01	2.93	9.47	2.28	8.65	
BCR/TC	1.86	1.81	1.84	1.34	4.34	1.05	3.97	
Genotypes	M-221	M-222	M-224	M-233	M-235	M-236	M-241	
Y (kg ha^{-1})	2094	1228	3854	2595	864	1758	1156	
P† (US$ kg-1)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
MP (US$ ha^{-1})	0.55	0.55	0.55	0.55	0.55	0.55	0.55	
BP (US$ ha^{-1})	58	34	107	72	24	49	32	
GI (US$ ha^{-1})	1159	680	2134	1437	478	973	640	
TVC (US$ ha^{-1})	280	280	280	280	280	280	280	
TFC (US$ ha^{-1})	58	34	107	72	24	49	32	
TC (US$ ha^{-1})	610	610	610	610	610	610	610	
GM	1217	714	2240	1508	502	1022	672	
NR (US$ ha^{-1})	607	104	1630	898	-108	412	62	
BCR/TCV	4.35	2.55	8.01	5.39	1.8	3.65	2.4	
BCR/TC	2	1.17	3.67	2.47	0.82	1.67	1.1	

Here, yield (Y), price (P), main product (MP), by product (BP), gross income (GI), total variable cost (TVC), total fixed cost (TFC), total cost (TC), gross margin (GR), net return (NR), benefit cost ratio (BCR). †price values were taken from Miah and Mondal (2017) and converted to US$; conversion rate 1 US$ = 84 BDT

In our study, gross income was higher in late maturing varieties compared to early maturing ones, but BCR of maximum late genotypes was not economical regarding the huge crop duration except for the lines M-215, M-219 and M-224. For establishing these lines as profitable crops, comparing the BCR of these lines with other competent rabi crops is required. Previous studies reported that BCR of maize is 1.63 (Rahman and Rahman, 2014), BCR of wheat is 1.40 (Hasan, 2006), BCR of boro rice is 1.14 (Baksh, 2003). On the other hand, three of our late maturing lines accounted for a BCR over the total variable costs, which were 4.34, 3.97 and 3.67. It can be assumed that these three lines can compete well with the other popular rabi crops. Rahman (2016) reported that farm size has no effect on the yield and profitability of mustard. Therefore, the small and marginal farm communities can be easily transferred into oilseed cultivation from the conventional cereal cultivation if they are provided with mustard cultivar with higher net return. Late maturing lines M-215 and M-219 are only 14-16 days late than the exiting varieties. This delay will not affect the total fixed cost and total variable cost significantly. Even if there is a slight rise in the total cost of production, the high BCR of genotypes M-215 and M-219 will compensate for the expenditure (Table 2).

4 Conclusion

Improvement of national rapeseed-mustard production is inevitable for reducing the huge import of edible oil. We conducted an economic analysis in late maturing and early maturing rapeseed and mustard genotypes for estimating their economic profitability. Almost all late maturing lines showed higher yield than early maturing. M-215, M-219 and M-224 lines were considered as profitable by comparing their benefit-cost ratio with early maturing lines. It is obvious from this study, that the late maturing genotypes contain higher yield potential. While working with these lines, economic feasibility must be taken into consideration, so that the extra cost of long duration can be compensated. Considering the tremendous yield potential, late maturing lines should be introduced at the farmers' level for boosting the national oilseed production.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Baksh ME. 2003. Economic efficiency and sustainability of wheat production in wheat-based cropping systems in north-west Bangladesh. PhD Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensingh, Bangladesh.

BB. 2019. Bangladesh Bank Annual Report 2018–2019. Bangladesh Bank. https://www.bb.org.bd/pub/annual/anreport/ar1819/full_2018_2019.pdf.

BBS. 2019. Yearbook of Agricultural Statistics. Statistics and Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh.

Begum M, Miah M, Matin M, Easmin F, Hossain M. 2020. Socioeconomic determinants of BARI mustard-14 adoption at farm level in selected areas of Bangladesh. Journal of Bangladesh Agricultural University :180doi: 10.5455/jbau.94761.

Carré P, Pouzet A. 2014. Rapeseed market, worldwide and in Europe. OCL 21:D102. doi: 10.1051/ocl/2013054.

Dey NC, Bala SK, Islam AKMS, Rashid MA. 2013. Sustainability of groundwater use for irrigation in northwest Bangladesh. National Food Policy Capacity Strengthening Programme (NFPCSP). Food Planning and Monitoring Unit (FPMU), Ministry of Food, FAO-Bangladesh, Dhaka.

Hasan MK. 2006. Yield gap in wheat production: a perspective of farm specific efficiency in Bangladesh. PhD Thesis, Department of Agricultural Economics, Bangladesh Agricultural University, Mymensing 2202, Bangladesh.

Islam QMS, Miah MAM, Alam QM. 2007. Economic analysis of BARI masur and mustard cultivation in selected areas of Bangladesh: A comparative study. Annual report 2006-07.Pp105-106. Agricultural Economics Division, BARI, Gazipur, Bangladesh.

Jyoti S, Islam M, Robin A. 2021. Comparative study of early and late maturing rapeseed and mustard genotypes for yield-related traits and fatty acid profiles. Journal of Bangladesh Agricultural University 19:310. doi: 10.5455/jbau.79510.

Miah MAM, Alam QM. 2008. Adoption and relative profitability of mustard production in Bangladesh. Annual Report of the Agricultural Economic Division, BARI, Gazipur, Bangladesh.

Miah MAM, Mondal MRI. 2017. Oilseeds sector of bangladesh: challenges and opportunities. SAARC Journal of Agriculture 15:161–172. doi: 10.3329/sja.v15i1.33146.

Nur-E-Nabi M, Haq ME, Ahmed M, Hossain MM, al Maruf MS, Mahmud F, Parveen S, Harun-Ur-Rashid M. 2019. Genetic variability, correlation and path coefficient analysis in advanced generation of *Brassica napus* L. Journal of Scientific Research and Reports 22:1–12. doi: 10.9734/jsrr/2019/v22i330090.

Rahman S. 2016. Profitability, input demand and output supply of mustard production in Bangladesh. https://pearl.plymouth.ac.uk/bitstream/handle/10026.1/4892/MS+11-16+Mustard-Profit+-+JOSR-SR.pdf?sequence=1.

Rahman S, Rahman S. 2014. Exploring the potential and performance of maize production in Bangladesh. International Journal of Agricultural Management 3:99–106.

Statistica. 2020. Vegetable oils: global consumption by oil type 2013/14 to 2019/2020. https://www.statista.com/statistics/263937/vegetable-oils-global-consumption/.

Uddin MT, Dhar AR. 2020. Assessing the impact of water-saving technologies on boro rice farming in Bangladesh: economic and environmental perspective. Irrigation Science 38:199–212. doi: 10.1007/s00271-019-00662-2.

USDA. 2019. Bangladesh: Oilseed And Products Annual Report. United States Department of Agriculture, Foreign Agricultural Service. https://www.fas.usda.gov/data/bangladesh-oilseeds-and-products-annual-1.

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