International Journal of Basic and Applied Biology
p-ISSN: 2394-5820, e-ISSN: 2349-2539, Volume 4, Issue 2; April-June, 2017, pp. 135-139

http://www.krishisanskriti.org/Publication.html

Seed Quality in Relation to Position of Siliqua on Plants of Mustard (*Brassica rapa*) Genotypes

Nation Chamling[1], Asit Kumar Basu[2] and Parmeshwar Devhade[3]

[1,2,3]Bidhan Chandra Krishi Viswavidyalaya
E-mail: [1]nationchamling@gmail.com, [2]asitkumarbasu@gmail.com, [3]prem6096@gmail.com

Abstract—*Five genotypes of Brassica rapa viz., Agrani, Benoy, Jhumka, Tori local and White flower were grown in field during two consecutive years- 2011-12 and 2012-13 following Randomized Block Design (RBD) with three replications. The present programme was carried out to evaluate the seed quality status based on position of siliquae on main stem and primary branches of the plant. It was found that all the positions were not equally productive, but differed significantly amongst three positions both on primary branches and main stem. Germination (%), speed of germination and vigour status obtained from siliquae positioned at the middle of either main stem or primary branch remained higher irrespective of the genotypes over the years.*

1. INTRODUCTION

Brassica oilseeds are important source of edible oil in many countries of the world, including India and China, the two big developing countries which are being confronted with ever increasing population and corresponding demand for agricultural products, but limited by the decline of arable land. Keeping these points in view, the present investigation on *Brassica* genotype was undertaken to evaluate the seed quality status based on its position on main stem (upper, middle and lower portion) and primary branches of the plant. Number of branches per plant is one of the important yield attributes in rape and mustard crop. Quality of seed, as determined by its vigour and viability, is dependent on many factors such as genetic makeup of the seed material, agronomic inputs, harvesting stage of the crop, position of siliquae on plant as well as prevailing environmental conditions to which the seed crop is exposed from sowing to seed harvesting. This experiment was carried out for two consecutive years to identify proper position of siliquae contributing good quality seed of *Brassica* genotypes.

2. MATERIALS AND METHODS

The present investigation was conducted during 2012 to 2014 at District Seed Farm ‘D’ Block, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal for the field experiments, while its laboratory components were conducted in the Department of Seed Science & Technology, Agronomy and Biotechnology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Ten plants were randomly harvested from each plot and each replication. Siliquae were harvested at different position on the main stem i.e., top, middle and bottom as well as from the primary branches of randomly selected five plants of each genotype. Seed quality assessment based on the position of siliqua on the plant was made on consecutive two years. Among those siliquae, length-breadth, number of siliqua at different positions, number of seeds per siliqua and test weight were compared and observations recorded for determination of quality status. Seeds separated from the collected siliqua were also subjected to germination test. Speed of germination, germination percentage, seedling root-shoot length, seedling fresh and dry weight and vigour index, were also determined for differences in quality status of the seeds produced at different position on the plant i.e., top, middle and bottom position of both primary branch and main stem.

3. RESULTS AND DISCUSSION

Seeds for three siliquae positions *viz*., top, middle and bottom from both primary branches and main stem were subjected to test for its quality status separately for five Brassica genotypes. The siliqua and seed characters studied included average length and breadth of siliqua, number of siliqua, number of seeds per siliqua and test weight of seeds from different positions, as well as germination percentage, speed of germination (Maguire ,1962) [2], seedling length and vigour index (Abdul-Baki and Anderson, 1973) [1] which were measured following standard procedures to assess the quality of the freshly harvested seeds.

Average siliqua length was recorded as maximum for Jhumka borne on main stem in both the years followed by that of the same variety borne on primary branch, while it was the shortest one borne on primary branch of Agrani, though it was statistically at par with that on main stem during second year. When average was made on genotypes and main/primary branch, longest siliquae were recovered from the bottom position, which was found to be insignificantly similar with that produced in middle position. Detailed analysis on combination of three factors indicate uniqueness of individual genotypes for its siliqua length: longest siliquae were borne on middle position of the main stem of Agrani in first year, it was of statistically similar length for other combinations of both main stem and primary branch with bottom and middle position, while in second year all the combinations of middle and bottom positions were significantly similar with each other; it were of longest type for combination between bottom position of main stem for Benoy and significantly similar with middle position of both primary branch and main stem; longest pods were produced on middle position of the main stem for Jhumka irrespective of the years of experimentation followed by other combinations of top and middle position with main stem and primary branches; siliquae were longest produced on bottom position of the main stem and it was statistically at par with the combination of bottom position and primary branch followed by combinations of middle position with main stem and bottom position with primary branch. Shortest siliquae could be recovered from top position of both main stem and primary branches irrespective of the genotypes and years of experimentation, probably due to natural source-sink relationship and blooming pattern on inflorescence in rapeseed and mustard; exception could be recorded for Benoy in both the years and Agrani in first year.

Maximum diameter of siliqua could be noticed for Jhumka borne on main stem in both the years followed by the same on primary branches of Jhumka, and White Flower borne on main stem; average breadth was higher for siliquae borne on main stem than that on primary branch irrespective of the genotypes and years of experimentation, exception was noticed for Tori Local in first year. Similar trend could be noticed for each genotype-main stem/primary branch combinations: average diameter of siliquae borne on main stem was found to be greater than those borne on primary branches irrespective of genotypes and its position exceptionally similar siliqua diameter could be noticed for Tori Local for both top and bottom position in both the years and from middle position during first year.

Consideration of genotype-main stem/primary branch and position of siliquae interaction effects indicate differential response based on genotypic preference. Higher number of siliquae on the middle position of both main stem and primary branch could be noticed for Benoy and Jhumka followed by bottom and top positions irrespective of the years of experimentation, though it was statistically at par for bottom and middle position on primary branches during first year. Unique scenario could be noticed for White Flower: number of siliquae borne on the bottom position of both main stem and primary branch were higher followed by that on middle and top positions on the main stem during the first year of experimentation, and these two were same in second year.

Higher number of seeds per siliqua could also be noticed for both main stem and primary branch of Benoy and White Flower; on the other hand, minimum number of seeds per siliqua was recorded for Agrani in both the years. When the detailed interaction effects were considered, it was apparent that numbers of seeds per siliqua on top position were always less than those produced from middle and bottom position irrespective of the genotypes and years of experimentation, but the same varied between main stem and primary branches depending on the genetic basis of individual genotypes. Similar trend was recorded for average influence of the siliqua position: numbers of seeds were higher for siliquae on the bottom position than that on the middle position for all the genotype-main stem/primary branch combinations. But the pattern of individual genotypes based on main stem/primary branch varied: number of seeds were higher at bottom position of primary branch for Benoy in both the years, for Tori Local and White Flower in first year only, and for Agrani in second year only; it was higher at the bottom position of main stem for Jhumka in both the years and Agrani in first year only; higher number of seeds per siliqua could be recorded on main stem of Jhumka only in both the years; and it was higher at bottom position of both main stem and primary branch in second year for Tori Local and White Flower, may have been resulted in due to varying response of the genotypes towards prevailing weather condition during post-fertilization siliqua and seed development of the same year. Observation of Yadav (1988) [5] on production of higher number of branches and number of siliqua per plant from basal branching group and its top ranking in seed yield per plant due to comparable number of seeds per siliqua and 100 seed weight may be utilized in support of clarification of the present findings.

Test weight was found to be significantly highest for seeds produced on main stem of White Flower followed by that on main stem of Jhumka and primary branch of White Flower in both the years, and it was clearly evident from Table 1 that seeds of higher test weight were produced on main stem in comparison to that on primary branch irrespective of the genotypes and years of experimentation with an exception for Tori Local in first year. Average test weight was higher for the seeds produced at the bottom position and then gradually declined with the progress to the top position in both the years. It was of significantly higher value for seeds produced on bottom position of the main stem irrespective of the genotypes, only exception could be noticed for seeds of Tori Local produced at middle position of the primary stem in first year. Test weight of seeds produced at top position of either main stem or primary branch was least, probably due to minimum translocation of photosynthates after fertilization and/or less time provided for development and maturation of those seeds. Primary branches on the upper half of the plant produced lower seed yield per plant than the same at basal portion (Satyavathi *et al*., 2001) [3]. Observation of Shikari and Sinhamahapatra (2004) [4] can also be utilized in support of the results of present findings in the manner that significantly less seeds were produced in the apically positioned siliquae along with lower test weights in *Brassica campestris* var. *yellow sarson*.

Average speed of germination, the initial indication of vigour status, was recorded to be maximum for seeds produced on main stem of White Flower in both the years followed by that of seeds from the same position for Benoy and Agrani, while the lowest speed was recorded for seeds produced on primary branch of Agrani preceded by those on both primary branch and main stem of Tori Local (Table 2). When average was made over genotype-main stem/primary branch combinations, seeds produced from middle position exhibited highest speed of germination followed by the same from bottom and top position respectively over the years. It was as high as 36.61 and 36.62 during consecutive years of experimentation, which was recorded for seeds of Benoy produced on middle position of the main stem. Trend in this parameter could be classified in different manners for seeds of individual genotypes: it was of significantly highest magnitude for seeds at middle position of main stem for White Flower, Benoy and Jhumka irrespective of the years of experimentation, while the same information could be achieved for seeds produced at middle position of primary branch for Tori Local in both the years; it could not follow any definite pattern for Agrani- higher magnitude of this parameter was recorded for seeds at middle position of both main stem and primary branch in first year seed, on the otherhand the same at middle position of main stem as well as bottom position of primary branch exhibited greater speed of germination in second year.

It is interesting to note that highest germination potential could be recorded for seeds produced on middle position on an average followed by the same on bottom and top position. No specific trend could be noticed for the seeds produced after interaction effects on different combinations, though the trend in average performance i.e. seeds produced at middle position were of higher germination potential for each genotype-main stem/primary branch combinations. It was of higher values for seeds produced at middle position of the main stem for Agrani in both the years, for Tori Local in first year and White Flower in second year; while it was of exactly similar magnitude for seeds produced on both main stem and primary branch of Jhumka over the years as well as for White Flower in first year and for Benoy in second year. Seeds produced at top position also were of highest germination potential for main stem in comparison to that for primary branch with the exception of Jhumka for which reverse scenario could be noticed. The higher germination potential as well as speed of germination of seeds produced at middle position irrespective of different combinations may have been generated due to overmaturation of seeds at lower position as well as comparatively less maturity of seeds at the top position at harvest and ultimately may be due to non-synchrony of siliqua maturity.

Significantly longest seedlings were produced from seeds on main stem of Tori Local in both the years followed by that on main stem of Benoy, primary branch of Tori Local, main stem of Jhumka and primary branch of Benoy in first year, while the positions of first two were interchanged in second year. Detailed clarification on performance of individual genotypes exhibited almost similar trend for length of seedlings over the years: seeds at middle position of main stem produced longest seedlings irrespective of the genotypes, though statistically similar performance could be noticed with the seeds produced at middle position of primary branch in second year for Agrani and Jhumka; similar performance could be noticed for seeds produced at both bottom and middle position on main stem and primary branch of Tori Local and White Flower in second year; and seedlings with short stature were produced from seeds at top position of primary branch with the exception of Agrani, Jhumka and White Flower in first year for which primary branch was replaced by the main stem.

Performance of the genotypes for seedling fresh weight varied over the years of experimentation may be due to favourable/unfavourable environmental condition prevailing in first/second year during post-fertilization development of seed till harvest maturity. Seedling fresh weight was maximum for seeds produced from main stem of Tori Local in first year followed by the same from primary branch of the same variety and Jhumka on both main stem and primary branch in first year. It was of highest magnitude in second year for seeds produced on primary branch of Benoy followed by the same on the primary branch of Tori Local and White Flower. Seeds produced on middle position exhibited higher seedling fresh weight, on an average, in both the years followed by bottom and top positions respectively. Average seedling dry weight was higher for seeds produced on main branch of individual genotypes in comparison to that for seeds produced on main stem of the same genotype irrespective of the years of experimentation, Benoy could be regarded as the exception in second year for which it became reverse. It was found to be maximum from seeds on main stem of Jhumka in both the years followed by that on main stem of Tori Local, while minimum seedling dry weight was recorded for both main stem and primary branch of Benoy. on ultimate interaction effects also recognized that seeds at middle position produced seedlings with higher dry matter for both main stem and primary branch of individual genotypes in general and it was of highest magnitude for individual genotypes in particular, when seeds were produced at middle position of the main stem. Magnitude of seedling dry weight was consistently less in second year irrespective of different combinations, in comparison to that in first year, may be due to unfavourable climatic conditions prevailed during seed development and maturation in second year.

Vigour Index of seed has been determined here as the joint function of germination (%) and seedling length. Average vigour index (Table 3) with higher magnitudes could be recorded for seeds produced on main stem of Benoy as well as seeds produced on main stem and primary branch of Tori Local over the years of experimentation, followed by that of seeds produced on primary branch and main stem of Jhumka and White Flower respectively, though these two were statistically similar with each other; while seeds with comparatively lower vigour status were observed to be produced on both main stem and primary branch of Agrani as well as on primary branch of both White Flower and Benoy over the years. Seeds produced on main stem were always of higher vigour status than those produced on primary branch irrespective of the genotypes and years of experimentation, only exception could be recorded for Jhumka for which the reverse trend could be noticed, though significant difference between the potentiality of the main stem and primary branch of Jhumka in this regard could not be recognized in first year. When average was made over the genotypes-main stem/primary branch, at the middle position followed by those at bottom and top position respectively in both the years. Consideration on potentiality of individual genotypes-main stem/primary branch and position of siliqua combinations for production of high vigour seeds indicated that seeds produced at middle position of main stem were always superior to other combinations irrespective of the genotypes over the years of experimentation though statistically similar potentiality could be noticed for seeds produced at middle position of main stem and primary branch in second year excepting for Agrani. Uniqueness in potential of individual genotypes could be assigned through detailed analysis on the performance of seeds produced on main stem or primary branch at different positions, inspite of minimum environmental influence.

4. CONCLUSION

It was found that all the positions were not equally productive, but differed significantly amongst apical, middle and bottom position both on primary branches as well as on the main stem. Germination (%), speed of germination and vigour status obtained from siliquae positioned at the middle of either main stem or primary branch on mother plant remained higher irrespective of the years of experimentation.

5. ACKNOWLEDGEMENT

The authors would like to appreciate Bidhan Chandra Krishi Viswavidyalaya for providing financial support for this research.

REFERENCES

[1] Abdul-Baki, A. A. and Anderson, J. D., “Vigour determination in soybean by multiple criteria”, *Crop Science*, 1973. 13: 630-633.

[2] Maguire, J. D., “Speed of germination - aid in selection and evaluation for seedling emergence and vigor”, *Crop Sci.*, 1962, 28: 181-207.

[3] Satyavathi, C.T.; Raut, R.N.; Bharadwaj, C., “Basal branching architecture in interspecific hybrids of *Brassica juncea*”, *Tropical Agricultur*, 2001, 78(4): 246-248.

[4] Shikari, A.B. and Sinhamahapatra, S. P., “Effect of siliqua angle on seed yield and its component attributes in tetralocular *Brassica campestris* var. *yellow sarson*”, *Cruciferae Newsletter*, 2004, 25: 57-58.

[5] Yadav, R.D.S., “Genetics of basal branching, adaxial hairy leaves and clumping flowering in mustard”, *Cruciferae*. 1988, 13: 27

Table 1: Test weight (g) based on its position on plant

Factors	Based upon position			
	C1	C2	C3	Mean
2012-13				
A1B1	0.194	0.256	0.264	0.238
A1B2	0.250	0.299	0.302	0.284
A2B1	0.217	0.259	0.307	0.261
A2B2	0.222	0.286	0.314	0.274
A3B1	0.254	0.274	0.284	0.271
A3B2	0.251	0.341	0.361	0.318
A4B1	0.261	0.284	0.274	0.273
A4B2	0.241	0.261	0.274	0.259
A5B1	0.277	0.291	0.314	0.294
A5B2	0.293	0.323	0.396	0.337
Mean	0.246	0.287	0.309	
	A X B	C	A X B X C	
SEm (±)	0.018	0.017	0.037	
CD at 5%	0.004	0.003	0.007	
2013-14				
A1B1	0.196	0.274	0.286	0.252
A1B2	0.270	0.304	0.306	0.293
A2B1	0.224	0.272	0.310	0.269
A2B2	0.242	0.308	0.324	0.291
A3B1	0.270	0.284	0.292	0.282
A3B2	0.272	0.352	0.374	0.333
A4B1	0.270	0.288	0.272	0.277
A4B2	0.260	0.296	0.292	0.283
A5B1	0.284	0.304	0.323	0.304
A5B2	0.312	0.350	0.404	0.355
Mean	0.260	0.303	0.318	
	A X B	C	A X B X C	
SEm (±)	0.019	0.018	0.038	
CD at 5%	0.005	0.004	0.008	

A1- Agrani, A2- Benoy,

A3- Jhumka, A4- Tori local,

A5- White flower,

B1- Primary branch, B2- Main stem,

C1- Top position, C2- Middle position,

C3- Bottom position

Table 2: Speed of germination based on its position on plant

Factors	Based upon position			
	C1	**C2**	**C3**	**Mean**
2012-13				
A1B1	11.45	30.55	28.74	23.58
A1B2	26.53	30.55	28.41	28.5
A2B1	20.36	31.61	27.59	26.52
A2B2	22.34	36.61	31.45	30.13
A3B1	20.58	27.64	26.33	24.85
A3B2	11.65	31.28	30.67	24.53
A4B1	18.56	32.61	29.56	26.91
A4B2	15.53	29.82	26.19	23.85
A5B1	16.27	29.66	25.63	23.85
A5B2	28.55	33.26	30.64	30.82
Mean	19.18	31.36	28.52	
	A X B	**C**	**A X B X C**	
SEm (±)	4.970	1.444	0.420	
CD at 5%	0.689	0.534	1.193	
2013-14				
A1B1	8.52	27.76	31.69	22.66
A1B2	24.27	30.6	26.55	27.14
A2B1	17.13	31.6	27.1	25.28
A2B2	25.41	36.62	33.58	31.87
A3B1	18.8	28.78	26.32	24.63
A3B2	9.04	31.62	30.25	23.64
A4B1	20.16	30.42	20.22	23.6
A4B2	18.4	28.43	23.35	23.39
A5B1	15.7	29.49	26.39	23.86
A5B2	31.13	37.52	31.74	33.46
Mean	18.86	31.28	27.72	
	A X B	**C**	**A X B X C**	
SEm (±)	5.511	2.362	0.416	
CD at 5%	0.682	0.528	1.181	

A1- Agrani, A2- Benoy,

A3- Jhumka, A4- Tori local,

A5- White flower,

B1- Primary branch, B2- Main stem,

C1- Top position, C2- Middle position,

C3- Bottom position

Table 3: Vigour index based on its position on plant

Factors	Based upon position			
	C1	**C2**	**C3**	**Mean**
2012-13				
A1B1	453.00	1340.29	1291.29	1028.19
A1B2	629.24	1586.77	1298.67	1171.56
A2B1	737.12	1466.14	1400.32	1201.19
A2B2	1231.15	1828.72	1644.61	1568.16
A3B1	876.61	1524.33	1486.54	1295.83
A3B2	513.65	1717.75	1590.19	1273.86
A4B1	1057.65	1590.36	1342.91	1330.31
A4B2	1138.32	1716.91	1550.95	1468.73
A5B1	715.09	1394.03	1276.61	1128.57
A5B2	798.67	1656.11	1375.57	1276.78
Mean	815.05	1582.14	1425.77	
	A X B	**C**	**A X B X C**	
SEm (±)	169.598	117.881	32.249	
CD at 5%	52.682	40.807	91.248	
2013-14				
A1B1	332.01	1491.71	1253.10	1025.61
A1B2	819.29	1642.05	1341.79	1267.71
A2B1	832.72	1641.78	1390.86	1288.45
A2B2	1110.97	1751.44	1496.10	1452.83
A3B1	786.05	1690.72	1563.35	1346.71
A3B2	427.56	1729.52	1552.12	1236.40
A4B1	1106.38	1654.05	1320.95	1360.46
A4B2	1174.29	1672.78	1539.59	1462.22
A5B1	563.66	1607.53	1502.44	1224.54
A5B2	846.05	1659.73	1533.72	1346.50
Mean	799.90	1654.13	1449.40	
	A X B	**C**	**A X B X C**	
SEm (±)	160.823	65.783	40.235	
CD at 5%	65.728	59.807	113.845	

A1- Agrani, A2- Benoy,

A3- Jhumka, A4- Tori local,

A5- White flower,

B1- Primary branch, B2- Main stem,

C1- Top position, C2- Middle position,

C3- Bottom position