Effect of temporal variability on phenology of brown sarson (*Brassica rapa* L. var. Oleifera): A mini review

Sabia Akhter*, Bilal Ahmad Lone, Shazia Ramzan, Ambreen Nabi, Vaseem Yousuf, Bhinish Shakeel, K.A. Zargar and Iram Farooq.

Krishi Vigyan Kendra Budgam, SKUAST-K, Shalimar, Srinagar, Jammu and Kashmir, India

Abstract

Time of sowing is very important for mustard production. Optimum sowing time plays an important role to exploit the genetic potential of a variety as it provides optimum growth conditions such as temperature, light, humidity and rainfall and it determines the length of growing season, time of flowering and also it has a great influence on dry matter accumulation, plant height, leaf area and leaf area index. Changes in sowing time expose the crop cycle to different environmental conditions, and thus modifying the duration of phenological phases. Phenological alterations are mainly due to photoperiod and temperature changes which affect some plant structures (e.g., number of leaf primordia and rate of leaf emergence), crucial for crop phenology. Delayed planting, unfavourable weather conditions during the flowering period, fertilization and pod formation can cause a decrease in duration of maturity period.

Keywords: Sowing date, Flowering, Dry matter, Mustard.

Introduction

Rapeseed and mustard are the major oilseed crops, traditionally grown everywhere in the country due to their high adaptability in conventional farming systems. Rapeseed-mustard a group of crops contributes 32 per cent of the total oilseed production in India, and it is the second largest indigenous oilseed crop after groundnut. Out of 72.37 million tonnes of estimated rapeseed-mustard produced over 36.59 million hectare in the world, India produces 6.26 million tonnes from 6.58 million hectare with 952 kg ha^{-1} productivity [1]. India is the third largest rapeseed-mustard producer in the world after China and Canada with 12 per cent of world's total production. India holds a premier position in rapeseed-mustard economy of the world with 2nd and 3rd rank in area and production, respectively. Due to the gap between domestic availability and actual consumption of edible oils, India's cooking oil imports will continue to grow at a high growth rate of 3.4% per annum till 2030 due to growing urbanization and changing dietary habits with a shift towards highly processed foods with high content of vegetable oils [2]. The research findings in India and other Rapeseed- mustard growing countries in recent years for the effect of date of sowing on phenology of rapeseed and mustard are reviewed and presented in this article.

Effect of date of sowing on growth and growth components

Pavlista reported that seeds of brown mustard (*Brassica juncea* cv. Arid), canola (*B. napus cv*. Hyola 401) and camelina (*Camelina sativa* cv. Boa) planted at the earliest date (24th February) did not emerge until after 3 weeks after planting but full emergence occurred by 3rd week after planting when planted on 24 March and 3 April and concludes that emergence occurred sooner as planting was later [3].

Days taken to flower initiation: Edward and Martin reported that flower initiation of rapeseed and mustard was earlier in 8th May than 29th May and 12th June [4]. The plants of first sowing (October 20) took the highest number of days (29 days) to first flowering but the plants of last planting (November 30) took the lowest number of days (25) to give first flower [5]. Aziz reported that the plants of 15th November sowing took significantly the highest number of days (35 days) to first flowers and 15th December sowing plants took the lowest number of days (29) to give first flower [6]. Pavlista reported that flowering dates for all three crops brown mustard (*Brassica juncea* cv. Arid), canola (*B. napus* cv. Hyola 401) and camelina (*Camelina sativa* cv. Boa) were later with a later planting date [3]. This was also agreed with canola flowering date reported in Saskatchewan [7]. Devi also reported that early sowing took the longest flowering duration followed by delayed sowing in mustard [8].

Days taken to 50% flowering: The first sowing (October 20) needed the highest number of days to 50% flowering (34 days). Plants of second (October 30), third (November10) and fourth sowing (November 20) needed 31 days and the last planting (November 30) took 29 days to give 50% plants to flower [5]. Similarly, Aziz reported that the first sowing (15th

***Correspondence to:** Sabia Akhter, Department of Crop Production, Krishi Vigyan Kendra, Budgam, Skuast Shalimar, Jammu and Kashmir, India, E-mail: sabiakhter77@gmail.com

Received: *18-Jul-2022, Manuscript No. AAERAR-22-69450;* ***Editor assigned:*** *20-Jul-2022, PreQC No. AAERAR-22-69450(PQ);* ***Reviewed:*** *02-Aug-2022, QC No. AAERAR-22-69450;* ***Published:*** *09-Aug-2022, DOI:10.35841/2529-8046-6.8.136*

Citation: *Akhter S, Lone BA, Ramzan S, et al. Effect of temporal variability on phenology of brown sarson (Brassica rapa L. var. Oleifera): A mini review. Environ Risk Assess Remediat. 2022;6(8):136*

November) took the highest number of days to 50% flowering (40 days) and plants of the last sowing (15th December) took 29 days [6].

Days taken to maturity: It has been reported that the maturity period of rapeseed became gradually shorter with the delayed sowing [9,10]. Bhuiyan recorded that early plantings of rapeseed required longer period to mature and delayed sowing reduces time to mature [5]. From 15th October onwards, a 12 day delay in sowing reduced the life span of the crop by 11 days and a 28 day delay reduced the life span by 16 days [11]. The longest period to mature (95 days) was required by the plants of 15th November sowing and it was followed by the second (25th November) and third sowings (5th December) [6]. Hokmalipour reported that first sowing date (30th March) reached to maturity later as compared to other sowing dates (14th April, 29th April and 14th May) [12].

Plant height

Plant heights of rapeseed cultivars indicated a significant decrease with delaying the sowing date [13]. Mondal and Islam also reported that sowing of mustard in the early November gave the highest plant height than in October and December [14]. Tharranum stated that higher plant height of mustard recorded with 14th October sowing as compared to 29th October, 13th November and 28th November sowing [11]. Kurmi and Panda also emphasized that the taller plant height was the result of the earlier sowing date (October> November> December) [13,15]. Razzaque also reported the highest plant height (120 cm) of rapeseed and mustard from 15 November sowing, which were reduced by 8%, 13.3% and 15% while seed were sown on 23 November, 30 November and 7 December, respectively [16]. Sowing of mustard during second fortnight of September recorded significantly higher plant height of 32.3, 116.8 and 125.4 cm as compared to first fortnight of October (25.8, 91.5 and 104.0 cm) at 30 DAS, 60 DAS and at harvest, respectively, [17]. Bhuiyan recorded the highest plant height, 115 cm from the plants of third planting (10 November) and it was significantly different from all other planting dates [5]. Maximum plant height (138.3 cm) was recorded in 30th August which was significantly different from January 30 planting [18]. Shargi revealed that late planting of canola on November 6th dramatically decreased plant height. Aziz reported the highest plant height (162.0 cm) from the plants of first sowing (15 November) whereas, the lowest plant height (124.1 cm) was reported from the plants of the last sowing (15th December) [6]. Hokmalipour reported highest plant height (84.86 cm) from 30th March and lowest plant height (19.46 cm) from 14th May [12]. Pavlista reported that plants of brown mustard, canola and camelina were tallest when seed was planted between 24 March and 10 April than 24th February and 3rd March [3].

Dry matter accumulation in leaves, stem and siliqua (g plant^{-1})

Surekha suggested that siliqua weight per plant recorded higher in 5th October sowing as compared to 5th and 20th November sowing. In New Delhi, Panda conducted a field experiment and reported that delayed sowing beyond 16th October reduced siliqua weight per plant [19]. Iraddi reported that, sowing during second fortnight of September recorded significantly higher dry matter in leaves (1.49 and 4.08 g) at 30 and 60 DAS and in stem (1.12, 11.81 and 15.39 g) at 30 DAS, 60 DAS and at harvest, respectively as compared to first fortnight of October sowing (1.24 and 3.68 g) at 30 DAS and 60 DAS in leaves and (0.86, 10.37 and 14.84 g) in stem at 30, 60 DAS and at harvest, respectively [17].

Total dry matter production

Sihag emphasized that the higher dry matter accumulation at 90 days of crop growth (31.07 g plant^{-1}) and at harvest (42.40 g plant^{-1}) was obtained with 15th October sown crop than delay sowing [20]. In New Delhi, Panda conducted a field experiment and quoted that total dry matter production decreased significantly with delayed sowing after 16th October [15]. Khushu reported that crop sown on 24th October recorded higher total dry matter production as compared to 8th November sown mustard [21]. Dry matter accumulation was maximum in 6th November sowing and thereafter the rate of biomass accumulation declined up to 27th November reported that sowing during second fortnight of September recorded significantly higher total dry matter of 2.61, 27.26 and 31.31 g plant^{-1} as compared to first fortnight of October (2.09, 22.84 and 29.96 g plant^{-1}) at 30, 60 DAS and at harvest, respectively [22-24]. Hokmalipour found that first sowing (30th March) gives maximum total dry matter while 14th May gives lowest total dry matter [12].

Leaf area per plant and leaf area index

Singh conducted a field trial at Faizabad (Uttar Pradesh) and recorded higher leaf area index (LAI) recorded higher under 14th October sowing as compared to 29th October, 13th November and 28th November sowing [11]. A field experiment was conducted by Panda at Indian Agricultural Research Institute, New Delhi and reported that delayed sowing beyond 16th October reduced the leaf area per plant as well as leaf area index [15]. Sowing during second fortnight of September recorded significantly higher leaf area (392.0 and 911.1 cm^2 per plant) as compared to first fortnight of October (385.0 and 894.0 cm^2 per plant) at 30 and 60 DAS, respectively reported by Iraddi [17].

References

1. Self-Extracting Archive (SEA), 2012. Rabi Rapeseed Mustard Crop Survey Report.
2. The Economic times. 2022.
3. Pavlista AD, Isbell TA, Baltensperger DD, *et al*. Planting date and development of spring-seeded irrigated canola, brown mustard and camelina. Ind Crops Prod. 2011; 33(2):451-456.
4. Edwards J, Martin P. The effect of sowing time on the yield and quality of canola (Brassica napus)–preliminary findings, differences. 2008; 42:42-50.
5. Bhuiyan MS, Mondol MR, Rahaman MA, et al. Yield and yield attributes of rapeseed as influenced by date of planting. Int J Sustain Crop Produc. 2008; 3(3):25-29.

Citation: *Akhter S, Lone BA, Ramzan S, et al. Effect of temporal variability on phenology of brown sarson (Brassica rapa L. var. Oleifera): A mini review. Environ Risk Assess Remediat. 2022;6(8):136*

6. Aziz MA, Chakma R, Ahmed M, et al. Effect of sowing dates on the growth, development and yield of mustard in the hilly areas. J Exp Biosci. 2011;2(1):33-36.

7. Kirkland KJ, Johnson EN. Alternative seeding dates (fall and April) affect Brassica napus canola yield and quality. Can J Plant Sci. 2000; 80(4):713-719.

8. Devi M, Sharma HK. Effect of sowing date on flowering and seed set of mustard (Brassica juncea L). J Entomol Zool Stud. 2017; 5(5):1534-1537.

9. Mondal RI, Biswas M, Hydar-Ali MK, et al. Response of rapeseed genotype Dhali to seed rate and seeding date. Bangladesh J Agric Res. 1999; 24(1):83-90.

10. Robertson MJ, Holland JF, Bambach R. Response of canola and Indian mustard to sowing date in the grain belt of north-eastern Australia. Aust J Exp Agric. 2004; 44(1):43- 52.

11. Tharranum M, Singh R, Niwas R, Singh D. Thermal time requirements and life span of Brassica species under different growing environments.

12. Hokmalipour S, Tobe A, Jafarzadeh B, et al. Effect of sowing date on dry matter accumulation trend, yield and some agronomic characteristics in canola (*Brassica napus* L.) cultivars. World Appl. Sci J. 2011;14(7):996-1002.

13. Kurmi K. Influence of sowing date on the performance of rapeseed and mustard varieties under rainfed situation of Southern Assam. J Oilseeds Res. 2002;19(2):197-198.

14. Mondal, MRI, Islam MA. Effect of seed rate and date of sowing on yield and yield components of rapeseed. Bangladesh J Agric Res. 1993;20(1): 29-33.

15. Panda BB, Shivay YS, Bandyopadhyay SK. Growth and development of Indian mustard (Brassica juncea) under different levels of irrigation and date of sowing. Indian J Plant Physiol. 2004;9(4):419-425.

16. Razzaque MA, Talukder MR, Uddin S, et al. Response of late sowing on the yield and yield contributing character of different varieties of mustard and rapeseed in coastal area of Barguna. Bangladesh J Sci Ind Res. 2007; 42(4):441-8.

17. Iraddi VS. Response of mustard (*Brassica juncea* L. Czernj and Cosson) Varieties to date of sowing and row spacing in Northern transition zone of Karnataka. Thesis Submitted to the University of Agricultural Sciences, Dharwad In partial fulfilment of the requirements for the Degree of Master of science (Agriculture) In Agronomy. 2008;55-81.

18. Rafiei S, Delkhosh B, Shirani Rad AH et al. Effect of sowing dates and irrigation regimes on agronomic traits of Indian mustard in semi-arid area of Takestan. Am J Sci. 2011;7(10):721-728.

19. Surekha E, Ramasubba Reddy G. Performance of mustard varieties under different dates of sowing. J Oilseeds Res. 1996;13:70-73.

20. Sihag JS, Manohar SS, Chaudhary T. Combined effect of sulphur and time of sowing on yield attributes, yield and quality of mustard (*Brassica juncea* L. Czern and Coss). Physiol J. 2003; 6(1/2):65-68.

21. Khushu MK, Tiku AK, Singh M. Photosynthetically active radiation (PAR) distribution in mustard canopy. Author contributions 5. 2011:9.

22. Taylor AJ, Smith CJ. Effect of sowing date and seeding rate on yield and yield components of irrigated canola (*Brassica napus* L.) grown on a red-brown earth in south-eastern Australia. Aust J Agric Res. 1992;43(7):1629-1641.

23. Angrej S, Dhingra KK, Jagroop S, et al. Effect of sowing time and plant density on growth, yield and quality of Ethiopian mustard (*Brassica carinata* A. Br.). J Res. 2002;39:471-475.

24. Ozer H. Sowing date and nitrogen rate effects on growth, yield and yield components of two summer rapeseed cultivars. Eur J Agron. 2003;19(3):453-463.

Citation: *Akhter S, Lone BA, Ramzan S, et al. Effect of temporal variability on phenology of brown sarson (Brassica rapa L. var. Oleifera): A mini review. Environ Risk Assess Remediat. 2022;6(8):136*