

Original Research Article

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Effect of Nipping on Growth, Assimilate Supply and Yield of Indian Mustard Genotypes

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ABSTRACT

The response of nipping on morpho-physiological parameters and yield of twenty two genotypes of Indian mustard [*Brassica juncea*(L.) Czern&Coss.] was studied in a field experiment. The results revealed that nipping significantly increased plant height, dry matters accumulation, number of primary and secondary branches per plant, number of siliqua per plant, seed yield (2678.146 kg ha⁻¹), harvest index (30.57%) over non-nipping, respectively. Among the genotypes, RH 1223 recorded highest plant height, whereas, RH 1117 recorded highest dry matter, per plant. The highest stem girth, primary and secondary branches and main shoot length at harvest were found in RH 555, RH 1215 and RH 1223, respectively. In the yield attributes, the number of siliqua on main shoot, number of seeds siliqua⁻¹, highest seed weight siliqua⁻¹ were found in RH 1118 and RH 1441, respectively. The RH 1118 recorded the highest biological yield (10480.470 kg ha⁻¹) and stover yield (7520.713 kg ha⁻¹), whereas, RH 1215 recorded the highest seed yield (3099.336 kg ha⁻¹), RH 1215 recorded the highest oil yield (1299.41 kg ha⁻¹), The maximum harvest index (34.87%) was recorded in RH 1215 respectively.

Keywords

Nipping, Mustard genotypes, Seed yield, Oil yield

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Introduction

India is the third largest rapeseed-mustard producer in the world after Canada and China. This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. India accounts for 17.27% and 9.07% of the total acreage and production of rapeseed-mustard (USDA 2016) respectively. Rajasthan is one of the major mustard producing states in the country, contributing 46.2% of total production of India. Although, yield of mustard in Rajasthan is more than its national average yield, but we

are still lagging behind as compared to the world's productivity. The burgeoning population of India would need about 58 million tonnes of oilseeds by the year 2020 for maintain their requirement of 15.5 kg/capita/annum from present level of 13.4 kg and to meet the industrial need in a sustainable manner in the coming years.

In spite of latest high yield varieties of Indian mustard, the potential yield of these varieties is still unexplored due several constraints like lack of proper crop establishment techniques and nutrient, water and weed management

techniques. Physiological manipulations may influence the plant source to sink relationship and ultimately yield. There is need to explore the advantage of simple agrotechniques like nipping, which suppresses the apical dominance and facilitates more lateral branches, ultimately resulting in more number of siliqua/plant and yield. There are reports on advantage of nipping in soybean, castor, chickpea and sunflower, however, so far no much research work has been done in Indian mustard. Therefore, a study was undertaken to find out the profitability of nipping in Indian mustard genotypes under rainfed conditions. Nipping in mutard is one of the important parameter for the enhancement of the yield and yield contributing parameters. Indian mustard one of the most important oil crops at national and international level, very little research work has been undertaken to study the subject. Therefore lacking to the above facts, the present investigation entitled "Effect of nipping on growth, assimilate supply and yield of Indian mustard genotypes" was carried out with objectives to study the effect of nipping on growth parameters, yield parameters and yield of different genotypes of Indian mustard.

Materials and Methods

The present investigation was conducted at ICAR-Directorate of Rapeseed- Mustard Research, Sewer, Bharatpur (Rajasthan) during the year 2016-17. The experiment was laid out at research farm of DRMR, during 'Rabi' season of 2016-2017. The centre lies on 27°15' North latitude, 77° 3' East longitudes and at an altitude of 178.37 meters above mean sea level. The region falls under Agro climatic Zone IIIA (semi-arid Eastern plain) with sub-tropical and semi-arid climate.

The climate of this zone is typically semi-arid and sub-tropical characterized by mid winter and moderate summers and associated with

relatively high humidity during the month of July-September. The mean annual rainfall is 650 mm, 85 percent mostly received from South-West monsoon during the last week of June to October. The average maximum and minimum temperature ranged between 20.8 to 40.9°C and 7.0 to 25.1°C during *rabi*2016-17, respectively. The mean daily evaporation from USWB class A pan evaporimeter ranged from 1.0 to 9.7 mm per day. The mean daily maximum and minimum relative humidity varied between (RH₁) 57.8 and (RH₂) 20.4 per cent. The bright sunshine hours varied from 5.9 in January to 10.3 in April during 2016-17. There was very low rainfall received during the month October 5.3 mm and 37.4 mm in January.

The treatments comprised of twenty two genotypes (RH- 555, RH- 1222-28, RH-1301, RH-749, IJ- 31, RH-1215, NRCHB-101, RH-1210, RH-1053, RH-1223, NRCDR-2, RH-601, RH-1140, RH-1118, RH-345, RH-1441, RH-1060, RH-1117, RH-1019, RH-1134, RH-1138, RH-1172) tested with nipping and without nipping in a Factorial Randomized Block Design and replicated thrice. The crop was sown on October 14, 2016 as per treatments and harvested on March 08, 2017. A uniform basal dose of 40 kg N + 40 kg P₂O₅/ha through urea and SSP was drilled prior to sowing. The remaining 40 kg N/ha was given by top dressing through urea at 30 DAS. Nipping was done by plucking the apical bud at 45 DAS with the help of a sharp blade. Five plants from the sampling rows were uprooted and used to compute the biometric and yield observations.

Results and Discussion

The nipping of genotypes responded differently and recorded significantly higher plant height compared non-nipping. Among the varieties RH 1223 recorded highest plant height (233 cm) at harvest followed by RH

1134 and RH 1140. At harvest nipping recorded highest primary branch which was 9.09 % higher over non-nipping. Among the varieties RH 1215 recorded highest primary branch (14) at harvest. Followed by RH 1210 (14) and NRCHB 101 (14) respectively. At harvest nipping recorded highest secondary branch which was 11.53% higher over non-nipping. Among the varieties NRCHB 101 recorded highest secondary branch (31) at harvest followed by RH 1215 (31) and RH 1223 (30), respectively. Nipping recorded highest siliqua on main shoot which was 23.80 % higher over non-nipping. Among the varieties RH 1118 recorded highest siliqua on main shoot (53). Followed RH 1172 (52) and RH 749 (51) respectively.

Nipping and genotypes significantly influenced the dry matter at all the growth stages. At 80 DAS nipping recorded highest dry matter which was 1.06% higher over non-nipping. Among the genotypes RH1301 recorded highest dry matter (326 g) at 80 DAS followed RH 1215 (307 g) and RH 1053 (306 g) respectively. At 120 DAS nipping recorded highest dry matter which was 6.79% higher over non-nipping. Among the genotypes RH 1117 recorded highest dry matter (681 g) at 120 DAS followed by RH 1172 (594 g) and

DRMRIJ 31 (577 g) respectively. Nipping and genotypes significantly influenced the per cent weight of seed to siliqua significantly at harvest. Nipping increased the weight of seeds to the weight of siliqua. Among the genotypes RH 1222-28 recorded highest per cent seed to siliqua weight (56.4%) under nipping, however, under non-nipping DRMR IJ 31 recorded highest seed to siliqua weight (57.4%). It showed that some of the genotypes recorded more diversion of assimilated to seeds than siliqua under nipping whereas others not.

Non-nipping/Nipping and varieties significantly influenced the seed yield and harvest index. Nipping recorded highest seed yield (2678.146 kg/ha) which was 12.38 % higher over non-nipping. Among the varieties RH 1215 recorded highest seed yield (3099 kg/ha) followed DRMRIJ 31 (3018 kg/ha) and RH 1118 (2959 kg/ha). Non-nipping/Nipping and varieties significantly influenced the harvest index % at all the growth stages. Nipping recorded highest harvest index % (30.6 %) which was 4.40 % higher over from non-nipping. Among the varieties RH 1215 recorded highest harvest index % (34.9 %) at followed DRMRIJ 31 (34.7 %) and NRCHB 101 (34.2%) (Fig. 1).

Fig.1 Effect of nipping of seed yield and harvest index of genotypes of Indian mustard. LSD (0.05) for seed yield=671, bars represents the standard error

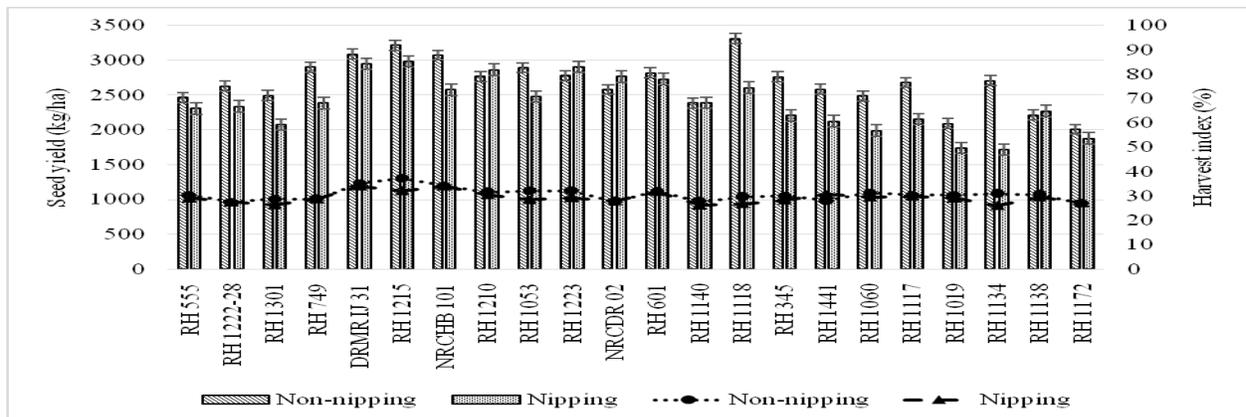


Table.1 Effect of nipping on growth parameters of mustard genotypes at harvest

	Nipping				Non-nipping			
	Plant height	Primary branches /plant	Secondary branches/plant	No. of siliqua on main shoot	Plant height	Primary branches/plant	Secondary branches/plant	No. of siliqua on main shoot
RH 555	214	12	27	41	208	9	24	48
RH 1222-28	221	13	22	39	213	10	27	55
RH 1301	217	13	21	40	220	12	30	57
RH 749	224	10	24	43	219	11	26	58
DRMR IJ 31	196	10	26	39	192	13	27	50
RH 1215	214	14	31	38	216	13	30	55
NRCHB 101	194	12	28	43	226	16	33	45
RH 1210	232	13	28	39	216	14	28	50
RH 1053	225	13	23	39	224	14	30	52
RH 1223	233	11	28	45	229	13	32	56
NRCDR 02	210	13	27	41	226	10	29	48
RH 601	223	11	28	41	214	12	28	55
RH 1140	202	10	23	38	206	12	32	50
RH 1118	225	10	26	50	208	13	30	57
RH 345	198	11	24	41	203	13	30	48
RH 1441	212	9	26	42	218	11	34	50
RH 1060	220	11	28	43	208	11	28	45
RH 1117	212	12	27	40	205	12	30	49
RH 1019	216	10	28	46	208	11	29	47
RH 1134	215	12	29	41	215	12	28	54
RH 1138	186	12	28	47	193	12	31	50
RH 1172	206	11	27	52	195	10	29	52
LSD (0.05)								
	Factor A				Factor B			
Plant height	2				8			
Primary branches/plant	0.2				1			
Secondary branches/plant	1				3			
No. of siliqua on main shoot	2				8			

Table.2 Effect of nipping on yield attributes of genotypes of Indian mustard

	Nipping		Non-nipping			
	Dry matter at 80 DAS	Dry matter at 120 DAS	Seed to siliqua wt. ratio (%)	Dry matter at 80 DAS	Dry matter at 120 DAS	Seed to siliqua wt. ratio (%)
RH 555	306	532	51.4	300	473	52.0
RH 1222-28	252	554	56.4	328	396	52.6
RH 1301	280	655	52.2	373	461	52.9
RH 749	255	396	55.5	234	646	52.6
DRMR IJ 31	315	402	55.9	265	751	57.4
RH 1215	279	579	54.0	335	523	55.4
NRCHB 101	305	360	55.3	259	530	56.7
RH 1210	368	565	53.2	276	419	52.9
RH 1053	295	474	49.2	317	352	52.4
RH 1223	282	566	52.4	285	442	56.7
NRCDR 02	249	336	52.0	318	342	47.9
RH 601	306	567	54.4	247	440	56.1
RH 1140	336	444	49.5	265	460	49.4
RH 1118	228	465	48.8	237	525	49.7
RH 345	300	286	49.0	254	312	50.2
RH 1441	250	325	51.8	335	473	49.8
RH 1060	209	570	54.3	320	510	53.1
RH 1117	219	841	51.9	319	522	52.3
RH 1019	322	526	49.7	257	472	56.4
RH 1134	333	460	52.7	242	417	50.3
RH 1138	290	548	53.5	277	331	53.3
RH 1172	249	619	51.5	251	570	51.7
LSD (0.05)						
	Factor A			Factor B		
Dry matter at 80 DAS	8			26		
Dry matter at 120 DAS	23			108		
Seed to siliqua wt. ratio (%)	2			6		
Test wt.	0.4			2		

Growth parameters

Significantly higher plant height, dry matters accumulation and number of primary and secondary branches per plant recorded at all the growth stages of plant as a result. Among several seed production approaches, terminal bud nipping is being commonly practiced in several crops to increase the seed yield and quality. In mustard, nipping of young tender top shoots though traditionally practiced by the farmers but its associated beneficial effects are scientifically documented. Apical bud nipping is known to alter the source-sink relationship by arresting the vegetative growth and hastening the reproductive phase. It also helps in production of more pod bearing branches thus, resulting in increased photosynthetic metabolic activity, accumulation of more photosynthates and metabolites, ultimately resulting in better seed quality with higher seed yield. Similar results were also obtained by (Thakral *et al.*, 1991). The reduction in plant height in nipped plants is mainly due to elimination of apical dominance and diversion of the plant metabolites from vertical growth to horizontal growth and recording more number of branches per plant. As the apical dominance is removed usually the plant itself adjusts to encourage the growth of auxiliary buds which may be converted into branches. Similar results were obtained by Arjun Sharma *et al.*, (2003) respectively (Table 2).

Yield attributes and yield

Increase in the seed yield by nipping might be due to increase in number of productive branches, leaf thickness, number of pods per plant, number of seeds per pod and total dry matter accumulation (Table 2). Similarly increase in yield due to nipping was also observed by Reddy (1997) and Arjun Sharma *et al.*, (2003) noticed the increase in seed yield due to significant reduction in plant

height and increase in the number of primary and secondary branches and pods per plant. Similar results were also obtained by Himayatullah *et al.*, (1989) and Aurangzeb *et al.*, (1996) respectively.

In conclusion, the experiment of nipping significantly increased plant growth and yield parameters and yield, oil content and uptake over non-nipping. The genotypes varied in the growth pattern and yield and quality. RH 1215 recorded highest dry matter, leaf area index and siliqua weight plant⁻¹, seed yield and oil yield. The stem girth, primary and secondary branches and main shoot length were highest in RH 1215, RH 1215 and RH 1223, respectively at harvest. The maximum yield attributes were found in RH 1215, whereas biological yield (10480 kg ha⁻¹) and stover yield (7520 kg ha⁻¹) were found maximum in RH 1118, The maximum harvest index (34.87%) was recorded in RH 1215 and DRMRIJ 31, respectively.

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