Optimizing the Seed Rate for Maximized Yield and Attribute Characters in Mustard under Loamy Soil under State of Uttar Pradesh, India

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Abstract — The experiment was conducted at Mohamadpur Gadhi (Gosaiganj) from 2019-2021 three year continue in same field and in same planting window (1st Nov to 10th November every year). The Latitude and longitude coordinates are: 26.767679 N, 81.111336 E and hight from sea level is 113m. It is a small neighbourhood of Lucknow under UP state. The experiment consists of one factor such as seed rate (S) with 5 types of seed rates in three replications viz. 1.5 kg (S1),2 kg (S2),2.5 kg (S3), 3 kg (S4) and 3.5 kg (S5). Used a single hybrid namely 5222 in RBD design with three replications. Seed rate had significant effect on yield, oil content & its economic. The optimum Plant height, no. of branches, no. of siliqua/plant, no. of seed /siliqua, 1000 seed wt., yield plot and yield ha were obtained in S2 with 2kg seed rate. However, it could be noted from the study that the interaction of seed rate in Hybrid 5222 with the seed rate (2 kg seed ha) produced the highest seed yield (2.73 t ha).

Keywords: Agriculture, Food Security, Edible Oil, Seed Rate, Mustard, Seed Yield. Test Weight of Mustard, Oil Content in Mustard, Plant Height in Mustard

I. INTRODUCTION

India is the third largest producer of rapeseed-mustard after Canada, China and contributing to around 11 % of world's total production. Rapeseed-mustard are the important oilseed crops and also one of the second largest oilseed crops in India. Globally around 36.59 million hectares area is under Rapeseed and mustard along with 72.37 million tonnes production and 1980 kg ha-1 productivity during 2018-19. India account for 19.8 % and 9.8% of the total acreage and production (USDA). In India around 9.8-million-hectare area is under Rapeseed and mustard along with 12 million tonnes production and 1346 kg/ha productivity (source DRMR). Rapeseed and mustard is cultivated in majority of states of the country, Rajasthan (3.97million ha), Madhya Pradesh (1.4 million ha), Uttar Pradesh (1.3 million ha), Haryana (0.73 million ha), West Bengal (0.66 million ha) in India, out of rapeseed-mustard, Indian mustard [Brassica juncea (L.)] is a predominant crop and covers more than 90% area of mustard. After soybean and palm oil, it is third important oilseed in the world. In Indian mustard oil contain varies from 37 to 42 percent with 38-57 % eruric acid, 27% oleic acid and seed & oil are used as condiment in the preparation of pickles, curries, vegetables, hair oils, medicines and manufacture of greases. The oil cake is used as feed for animals and manure (5.1 % N, 1.8% P_2O_5 and 1.1 % K_2O). Oil cake or meal has high nutritional values in animal diet. Leaves of the young plants are used as green vegetables and green stem leaves are a good source of green fodder for cattle. In tanning industry, mustard oil is used for softening of leather. Rapeseed – mustard crops in India are grown in diverse agro climatic conditions ranging from north-eastern /north –western hills to down south under irrigated /rain fed timely/late sown, saline and mixed cropping (Gupta et al., 2020). Rapeseed and mustard is crops of tropical as well as temperate zones and require somewhat cool and dry weather for proper growth. They require a fair supply of soil moisture during the growing period and a dry clear weather at the time of maturity. Cool temperature, clear dry weather with plentiful of bright sunshine accompanied with sufficient soil moisture increase the oil yield. In India grown in Rabi season from September – October to February – March.

They are used in Asian dishes to add spice and flavour to cooked dishes. In India, and Asian countries, mustard is popularly used in Indian cooking. India is number one in production of mustard oil. Mustard gives edible oil which is used as cooking. In many Indian preparations, mustard seeds (along with other spices and condiments) are heated in clarified butter or oil before being added as the final flavouring (called tempering) after the dish has been prepared. Mustard contains antioxidants and other beneficial plant compounds thought to help protect your body against damage and disease. For instance, it's a great source of glucosinolates, a group of sulfur-containing compounds found in all cruciferous vegetables, including broccoli, cabbage, Brussels sprouts, and mustard.

II. FUTURE SCOPE

Average hybrid mustard seed recommendation is 2.5kg per hectare for sowing in India. Now we can use few less seed quantities with highest yield with 2kg seed rate. Seed should be healthy with a good germination percentage. Appropriate seed rate management with germination is on the basis of critical growth stage approach will be the best option for increasing Mustard productivity, oil%, oil quality and farmer's economic benefit. Selection of seeds & Seed rate are important for producer to achieve high crop yield.

III. MATERIALS AND METHODS

The experiment was conducted at Mohamadpur Gadhi (Gosaiganj) from 2019-2021 three year continue in same field and about same planting window (1st Nov to 10th November every year). Generally, The soil fertility status of the experimental fields was moderate, having medium status of organic matter. The experimental field was also a piece of well drained high land with moderately even topography.

The experiment consists of one factor such as seed rate (S) with four types of seed rates in three replications viz. 1.5 kg (S1),2 kg (S2),2.5 kg (S3), 3 kg (S4) and 3.5 kg (S5). Used a single hybrid namely 5222 in RBD design with three replications. Used a single hybrid namely 5222 in RBD design with three replications. The size of each plot was 5m×5m (25 sqm) with broad casting methods. Seed were sown in properly prepared land on 5 November. Applied recommended fertilizers dose viz 80kg (N), 40kg (P_2O_5) and 40kg (K_2O) and 50% N and entire dose of P_2O_5 and K_2O as basal and rest 50% N at 3 weeks stage. Intercultural operations were done as and when necessary and applied two irrigations in experimental plant. The crop was harvested at proper physiological maturity when crop & Siliquae was under golden brown. Before harvesting, 10 plants were randomly selected from each plot for collecting data on yield attributes. Data were collected on plant height, no. of leaves plant, no. of filled siliqua plant, no. of seed siliqua, 1000 seed wt., oil content, seed yield plot and seed yield hectare. The collected data were analysed scientifically.

IV. RESULTS AND DISCUSSION

A. *Effect of treatments on growth attributing characters*

The no. of primary, secondary & treasury branches were significantly higher in treatment S2 (122) then S3 (90), S4 (59),S5 (41) and at par with S1 (126).Effect of treatments on yield component has been presented in Table 1.

Treatments	2019-20			2020-21			2021-22			Average		
	Primary	Secondary	Tracery	Primary	Secondary	Tracery	Primary	Secondary	Tracery	Primary	Secondary	Tracery
S1 (1.5 kg)	12	23	56	10	19	49	13	21	58	27	48	126
S2 (2 kg)	10	20	54	11	20	50	11	18	54	25	45	122
S3 (2.5 kg)	8	15	46	9	16	39	8	14	36	20	35	90
S4 (3 kg)	7	10	33	6	11	21	6	11	27	14	25	59
S5 (3.5 kg)	4	7	25	3	6	14	5	5	19	9	13	41
SE(m)±	0.46	0.71	1.27	0.67	1.76	4.65	0.87	1.44	5.31			
CD (5%)	1.50	2.33	4.14	2.08	6.34	8.56	2.59	5.49	8.88			

Table 1: Effect of treatments on Branches

One of the most chronic constraints to mustard crop production is the grain yield reduction near the crop harvest stage by lodging worldwide. This is more prevalent in Mustard crop. Major factors associated with lodging involve high plant height, morphological and anatomical traits along with the chemical composition of the stem. Plant height is lesser in S2 (460.81) then S3 (462.69), S4 (475.03),S5 (476.48) and at Higher then S1 (448.32). Effect of treatments on plant height component has been presented in Table 2.

Treatments	2019-20				2020-21				2021-22				Average			
	30DAS	60DAS	90DAS	125 DAS (At harvest)	30DAS	60DAS	90DAS	125 DAS (At harvest)	30DAS	60DAS	90DAS	125 DAS (At harvest)	30DAS	60DAS	90DAS	125 DAS (At harvest)
S1 (1.5 kg)	32.41	80.32	170.4	188.25	30.22	67.22	160	190.45	31.34	86.49	180.34	195.12	72.36	180.48	397.59	448.32
S2 (2 kg)	33.54	82.33	175.3	195.41	34.65	79.11	170	193.23	33.76	90.34	187.34	202.44	79.59	196.89	416.13	460.81
S3 (2.5 kg)	34.12	85.42	190.3	203.66	39.45	82.12	176	196.35	33.65	85.36	190.45	198.45	84.47	195.95	429.45	462.69
S4 (3 kg)	34.24	88.12	191.5	210.72	32.54	81.36	178	199.34	30.45	84.56	192.34	205.45	74.40	195.29	434.55	475.03
S5 (3.5 kg)	33.11	84.23	180.1	200.11	32.34	80.35	179	200.33	32.45	86.44	187.96	209.45	75.83	194.87	427.49	476.48
SE(m)±	1.02	2.18	2.12	2.26	1.12	2.38	2.42	2.23	1.32	2.31	2.19	2.16				
CD (5%)	3.34	7.11	6.91	7.37	3.24	7.21	6.34	7.67	3.40	7.22	6.45	7.45				

Table 2: Effect of treatments on plant height

Number of siliqua/ plant and no. of seeds/siliqua were significantly influenced by Hybrid & Seed rate. Recorded significantly higher silique in treatment S2 (562) then S3 (478.33), S4 (403.33),S5 (270.33) and lesser then S1 (596.33).Effect of treatments on yield component has been presented in Table 3.

Treatments	No of Silique/ plant (no)			Average	No of seeds/ Silique (no)			Average
	2019-20	2020-21	2021-22		2019-20	2020-21	2021-22	
S1 (1.5 kg)	605	586	598	596	18.22	18.14	17.56	17.97
S2 (2 kg)	534	571	581	562	17.24	17.32	18.24	17.60
S3 (2.5 kg)	462	471	502	478	16.11	16.54	17.38	16.68
S4 (3 kg)	411	401	398	403	16.33	16.71	16.49	16.51
S5 (3.5 kg)	254	276	281	270	17.12	16.22	16.22	16.52
SE(m)±	16.96	14.56	12.59		0.26	0.25	0.23	
CD (5%)	55.31	54.31	51.08		0.84	0.82	0.83	

Table 3: Effect of treatments on no of siliqua & no of seeds

B. *Effect of treatments on yield and economics*

Seed yield is the ultimate goal of mustard cultivation. Seed rate had significant influenced on the seed yield of mustard. Seed yield per hectare ranged from 2475.12 kg to 1748.11 kg.The highest seed yield (2739.42 kg) was produced at S2 and lowest one (2064.43kg) was obtained from S5. In S1 seed yield was 2475.12 kg followed by S3 (2293.87 kg), S4(2064.43kg) and S5 (1748.11kg). The reason of the highest seed yield might be due to the highest value at all the yield contributing characters such as branches, number of siliqua per plant and number of seeds. Effect of treatments on yield has been presented in Table 4,5,6

Treatments	Test weight (gm)			Average	Oil %			Average
	2019-20	2020-21	2021-22		2019-20	2020-21	2021-22	
S1 (1.5 kg)	5.55	5.76	5.44	5.58	41.12	40.56	41.39	41.02
S2 (2 kg)	5.23	5.51	5.72	5.49	41.02	41.28	41.31	41.20
S3 (2.5 kg)	5.11	5.03	5.05	5.06	40.92	40.21	41.22	40.78
S4 (3 kg)	5.05	5.21	4,89	5.13	40.54	40.01	40.76	40.44
S5 (3.5 kg)	5.12	4.65	4.87	4.88	40.98	39.65	40.03	40.22
SE(m)±	0.78	0.65	0.54		0.21	0.20	0.23	
CD (5%)	2.53	2.43	2.23		0.68	0.55	0.67	

Table 4: Effect of treatments on test weight & Oil%

Treatments	Grain Yield kg/ha			Average	Economics /MSP			Average
					4425	4650	5050	
	2019-20	2020-21	2021-22		2019-20	2020-21	2021-22	
S1 (1.5 kg)	2450.71	2387.42	2587.22	2475.12	108444	111015	130655	116705
S2 (2 kg)	2655.45	2765.46	2797.35	2739.42	117504	128594	141266	129121
S3 (2.5 kg)	2348.46	2187.87	2345.28	2293.87	103919	101736	118437	108031
S4 (3 kg)	2071.14	2073.72	2048.44	2064.43	91648	96428	103446	97174
S5 (3.5 kg)	1667.23	1798.61	1778.48	1748.11	73775	83635	89813	82408
SE(m)±	36.0	34.6	32.5		1837.9	1673.6	1784.4	
CD (5%)	117.3	112.5	110.3		5993.6	5547.9	5752.8	

Table 5: Effect of treatments on Grain Yield & Gross Return

Treatments	plant height (cm)				Branching habit (no)			No of Silique/ plant (no)	No of seeds/ Silique (no)	Days to maturity	Test weight (gm)	Grain Yield kg/ha	Oil %	Economics Rs/Ha
	30DAS	60DAS	90DAS	125 DAS (At harvest)	Primary	Secondary	Tracery							
S1 (1.5 kg)	72.36	180.48	397.59	448.32	27	48	126	596.33	17.97	126	5.58	2475.12	41.02	116705
S2 (2 kg)	79.59	196.89	416.13	460.81	25	45	122	562.00	17.60	126	5.49	2739.42	41.20	129121
S3 (2.5 kg)	84.47	195.95	429.45	462.69	20	35	90	478.33	16.68	128	5.06	2293.87	40.78	108031
S4 (3 kg)	74.40	195.29	434.55	475.03	14	25	59	403.33	16.51	129	5.13	2064.43	40.44	97174
S5 (3.5 kg)	75.83	194.87	427.49	476.48	9	13	41	270.33	16.52	130	4.88	1748.11	40.22	82408

Table 6: Effect of treatments on all major components

V. Conclusion

From the above study continue three years, it may be concluded that 2 kg seed rate per hectare is better to get higher yield of mustard hybrid in Lucknow district of Uttar Pradesh, India.

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