

Effect of moisture conservation practices on, yield attributes, yield and quality of Indian mustard [*Brassicajuncea(L.) Czern&Coss*]

ABSTRACT

A field experiment was carried out during two consecutive years (2016-17 and 2017-18) at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyala, Chitrakoot, Satna, (M.P.). India to evaluate the effect of moisture conservation practices on growth, yield attributes and yield of mustard under rainfed condition. Treatment consisted four moisture conservation practices i.e. no irrigation, life saving irrigation, straw mulch (Paddy straw @ 4t/ha) and kaolin 5 % spray. Result revealed that on pooled basis the tallest plant of 195 cm was recorded under life saving irrigation but number of branches (6.82) and dry weight per plant (39.8 cm) were significantly maximum in straw mulch treatment. The yield attributes such as siliqua per plant (298.5), seeds/siliqua (15.9), siliqua length (3.97 cm), seed weight per plant (17.06 g) and 1000- seed weight (5.57 g) were significantly superior under straw mulch followed by life saving irrigation. Significantly highest seed yield (2558 kg/ha), oil content (42.0 %) and protein content (20.5%) were obtained under straw mulch treatment while numerical enhancement was observed in life saving irrigation and kaolin 5% spray over no irrigation.

KEYWORDS: Straw mulch, Kaolin, Yield attributes, Yield, life saving irrigation.

INTRODUCTION

India is one of the major oilseed producing country in the world. Oilseed is major group of crop where in Govt. of India is giving importance to enhance their production mainly due to avoid heavy import bill on edible oils. The gap between the supply and demand has been created due to increasing population, improvement in living standard of people and stagnation in production of crops. Among oilseed crops, Rape seed –mustard is most important *rabi* season crop comprising seven different species viz. Indian mustard, toria, yellow sarson, brown sarson, gobhisarson, karanrai and taramira. The estimated area, production and average yield of mustard in the world was 36.68 million hectares, 72.42 million tonnes and average yield 1974 kg/ha during 2017 -18. During all last seven years there has been a considerable increase in productivity from 1840 kg/ha in 2010 -11 to 1974 kg/ha in 2017 -18 and production has also increased from 61.64 mt. in 2010 to 72.42 mt. in 2017 -18 [4]. In India rapeseed – mustard is grown over an area of 6.07 mha, was a corresponding production of 7.92 mt and average production is 1304 kg/ha during 2016-17. In India Madhya Pradesh is one of the important rapeseed–mustard growing state after Rajasthan and Uttar Pradesh having an area of 1.52 mha with corresponding production of 3.28mt and average yield of 2175 kg/ha in 2018–19 [4]. Rapeseed – mustard is mostly gram under rainfed condition. Under such situation mustard crop suffer from soilmoisture deficit

which after crop growth and yield adversely. Soil moisture is lost due to evapotranspiration. Plants contain about 90-95 % water photosynthesis takes place in the presence of water, plants absorb nutrients through soil solution. The growth of microorganisms was done through soil moisture. Straw mulch prevents direct evaporation of moisture from soil, reduces weed growth, control of temperature fluctuations and improved soil condition. Kaolin is a reflecting type antitranspirant. After applied to transpiring plant surface from reducing water loss from the plant after spray of kaolin a coating layer is formed on leaf and plant surface which reflect solar radiation resulted water loss reduced through leaves transpiration from plant. Kaolin reduced the leaf temperature 3 to 4°C, temperature by 22 to 28 % without affecting photosynthesis [1].

Thus with consideration of these views, present investigation was undertaken.

MATERIALS AND METHODS

The present field experiment was conducted during *rabi* season of 2016-17 and 2017-18 at Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.). Treatment consisted four moisture conservation practices viz. No irrigation, life saving irrigation, no irrigation + straw mulch of paddy @ 4t/ha, no irrigation + kaolin 5 % spray at 35DAS stage. Thus four treatments were tried in three replicated randomized block design. The soil of experimental plot was sandy loam in texture having soil pH 7.6, organic carbon 0.51 %, available nitrogen 168 kg/ha, available phosphorus 17.8 kg/ha and available potassium 350 kg/ha. The mustard crop (*v. Pusamahak*) was sown on 02 November 2016 and 03 November 2017 at distance to 45 cm in furrows. After 15 DAS plant spacing was maintained 15 cm through manual thinning operation. Crop was fertilized @ 120 kg N + 60 kg P₂O₅ + 30 kg K₂O/ha through urea, DAP and muriate of potash, respectively. Half quantity of N + full quantity of P₂O₅ and K₂O was basally applied at sowing and remaining half N by topdressing after 30 DAS in T₁: irrigation was not given, in T₂ one irrigation was given at 35 DAS, in T₃ straw mulch of paddy @ 4t/ha was spread 30 DAS of crop in plot and in T₄ kaolin 5 % spray at 35 DAS. Remaining all the package of practices was adopted as per recordation of crop. The crop was harvested on 01 April 2017 and 05 April 2018. The growth parameters viz. plant height, number of branches and dry weight / plant were recorded at 50 DAS. Yield attributes and yields were recorded at harvest and threshing of crop. The oil content in seed of mustard directly analysed by NIR (Near Infrared Reflectance) [2]. Protein was computed by multiplying the N-content of seed with a factor of 6.25. The total N content was determined by an adopting modified kjeldals method.

RESULTS AND DISCUSSION

Growth parameters

Plant height, number of branches and dry weight (Table 1) per plant were significantly differed with moisture conservation practices during both years and in pooled. Life saving irrigation treatment produced significantly tallest plant (195.6 cm) than no irrigation, straw mulch and kaolin 5 % spray. The formation of branches /plant and dry weight /plant were significantly

maximum under straw mulch treatment (6.82 branches and 39.8 g dry weight) than no irrigation and atpar to remaining treatments on pooled basis as well as year wise . On pooled basis, life saving irrigation, straw mulch and kaolin 5 % spray improve dry weight / plant by 1.5 g, 4.9g and 0.8 g /plant over control, respectively. The increase in life saving irrigation was due to beneficial effect of irrigation on growth of crop, straw mulch due to check evaporation from soil and reduced weed density and maintains soil temperature while kaolin 5 % spray reduced transpiration of water from leaf reported similar findings[3].

Yield attributes

It is evident from table -2 that yield attributes of mustard such as number of siliqua / plant , number of seeds / siliqua , length of siliqua, seed weight / plant and 1000 –seed weight were significantly varied with moisture conservation practices during 2016-17, 2017-18 and in pooled. On pooled basis, the highest siliqua / plant (298.5), seeds/ siliqua (15.9), siliqua length (3.97cm) seed weight /plant (17.06g) and 1000- grain weight (5.57g) were found under straw mulch treatment than no irrigation. It was attributed due to growth parameters particularly in dry weight/plant. Role of moisture conservation practices already mentioned above.[6], [3] and [5] corroborated these findings. Numerical enhancement on yield attributes of mustard was observed in life saving irrigation and kaolin 5 % spray over no irrigation.

Yields and harvest index

The grain yield, stover yield and harvest index were found significantly maximum under straw mulch treatment during both years of experimentation and in pooled. On pooled value basis life saving irrigation, straw mulch and kaolin 5 % spray increased grain yield by a margin of 94 kg or 4.19 % , 312 kg or 13.89 % and 47 kg /ha or 2.09 % as well as stover yield by 198 kg (4.18 %) , 659kg (13.90 %) and 99 kg (2.09 %) over no irrigation, respectively. The yield attributes and dry weight / plants were supported the findings of grain and stover yield. It was due to beneficial role of moisture conservation practices on growth and yield of mustard. Better growth parameter formed superior yield attributes as well as seed and stover yield. The trend of harvest index was similar to grain and stover yield. These results are in conformity with [7], [6],[3], [5] and [8].

Quality parameters

It is obvious from table 3 that the oil and protein content in mustard seed were significantly influenced due to moisture conservation practices during both years and in pooled. Straw mulch treated plot had significantly maximum oil content (42.0 %) and protein content (20.5 %) on pooled basis. Remaining treatment enhanced oil and protein content numerically over no irrigation. It was probably due to moisture conservation practices formed bolder seeds and more uptake of nutrients (NPK) while no irrigation treatment formed small and shrunked seed due to lower uptake of nutrients hence oil and protein content was poor. It was also supported by seed size (1000- seed weight in table 2).

CONCLUSION:

Thus it can be concluded that most effective moisture conservation practices of straw mulch @ 4t/ha was found best treatment for obtaining maximum yield attributes, yield and quality of mustard for Kymore Plateau region of Madhya Pradesh.

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Table- 1 Effect of cropping system and moisture conservation practices on plant height (cm), number of branches / plant and dry weight (g) at 50 DAS of mustard crop.

Treatment	Plant height (cm) at 50 DAS			Branches / plant (number) at 50 DAS			Dry weight / plant of mustard (g) 50 DAS		
	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled	2016-2017	2017-2018	Pooled
No Irrigation	178.2	181.7	179.9	5.76	6.22	5.99	33.6	36.3	34.9
Life Saving Irrigation	193.7	197.6	195.6	6.00	6.48	6.24	35.0	37.8	36.4
No Irrigation + Life Saving Irrigation	186.6	190.4	188.5	6.56	7.08	6.82	38.3	41.3	39.8
No Irrigation + kaolin 5 % spray	188.1	191.8	189.9	5.88	6.35	6.12	34.3	37.0	35.7
SEm ±	0.96	0.98	0.96	0.09	0.10	0.09	0.53	0.54	0.55
C.D. (P = 0.05)	2.82	2.90	2.82	0.27	0.29	0.28	1.56	1.68	1.62

TABLE-2 Effect of moisture conservation practices on number of siliqua, seeds per siliqua, siliqua length and 1000- seeds weight (g) of mustard.

Treatment	Number of siliqua/plant			Number of seeds/siliqua			Siliqua/length (cm)			1000- seeds weight (g)		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
Moisture Conservation Practices												
No Irrigation	252.0	277.2	262.1	13.4	14.5	14.0	3.37	3.63	3.50	4.70	5.08	4.89
Life Saving Irrigation	262.5	283.5	273.0	14.0	15.1	14.6	3.50	3.80	3.65	4.90	5.29	5.10
No Irrigation + Life Saving Irrigation	287.0	310.0	298.5	15.3	16.5	15.9	3.80	4.13	3.97	5.36	5.79	5.57
No Irrigation + kaolin 5 % spray	257.3	277.8	267.5	13.7	14.8	14.3	3.43	3.70	3.57	4.80	5.19	4.99
SEm ±	4.56	4.92	4.74	0.21	0.23	0.22	0.05	0.06	0.05	0.08	0.09	0.09
C.D. (P = 0.05)	13.44	14.52	13.98	0.62	0.67	0.65	0.16	0.17	0.16	0.24	0.26	0.25

Table-3- Effect of moisture conservation practices on seed yield per plant (g), grain yield (kg/ha), stover yield (kg/ha), oil and protein content (%) in mustard (seed) crop.

Moisture conservation practices	Seed yield/plant (g)			Grain yield (kg/ha)			Stover yield (kg/ha)			Harvest index			Oil content in seed (%)			Protein content in seed		
	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
No irrigation	14.40	15.15	14.98	2160	2333	2246	4560	4925	4742	28.8	31.1	30.0	40.2	41.0	40.6	19.6	20.0	19.8
Life saving irrigation	15.00	16.20	15.60	2250	3430	2340	4750	5130	4940	30.0	32.4	31.2	40.8	41.6	41.2	19.9	20.3	20.1
Straw mulch	16.40	17.71	17.06	2460	2657	2558	5193	5609	5401	32.08	35.4	34.1	41.6	42.4	42.0	20.3	20.7	20.5
Kaolin 5% spray	14.70	15.88	15.29	2205	2381	2293	4655	5027	4841	29.4	31.8	30.6	40.6	41.4	41.0	19.8	20.2	20.0
S.E.M. ±	0.23	0.24	0.24	34	37	18	72	77	47	0.45	0.49	0.47	0.16	0.16	0.16	0.08	0.08	0.08
C.D.(P=0.05)	0.67	0.72	0.69	100	108	53	211	288	220	1.33	1.44	1.39	0.48	0.48	0.48	0.23	0.24	0.24

UNDER PEER REVIEW